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Design of a Sewage Disposal Scheme for a City Located on Tidal Waters*

Consideration of the problems encountered for a typical city on tidal waters, calculations of dry-weather and storm flow; hydraulic design of necessary sewers and pumping station.

C. J. Yorath, A.M.E.I.C., A.M.I.C.E.

Advance proof of Paper to be presented at the General Professional Meeting, Toronto, February 2nd and 3rd, 1921.

The question of disposing of a seaside city's sewage is becoming one of the most difficult which municipal engineers have to deal with, and present-day sanitary ideals make it more so.

Until quite recently it was thought by authorities on sewage disposal that all that was required to be done to get rid of a seaside city's sewage was to discharge it into the sea at the nearest point. The contamination by sewage of fishing grounds, and the detrimental effect to seaside resorts by the discharge of sewage upon the foreshore have created not only engineering difficulties, but oftentimes heavy expenditure through having so to design the main outfall sewer of a large town as to eliminate these two objections.

In order, therefore, to design a sewage disposal scheme so that the objection of the seaside resort may be removed and the fishing grounds may run no risk of contamination, it will be necessary very carefully to consider the position of the outfall and also if it will be necessary to treat the sewage or storm water before discharge.

The assumed factors, which have brought about the necessity of a main drainage scheme, such as will be described, are:—

(a) Owing to the very rapid growth of the city the existing outfall has proved inadequate, and is unable to store the necessary quantity of sewage during such time as it is possible to discharge, having regard to the state of the tide. In consequence of this, flooding occurs.

(b) An injunction has been obtained against the city council to prevent it discharging sewage to the detriment of the fishing grounds.

(c) Many complaints that the bathing grounds and foreshore are polluted with sewage.

It will be seen, therefore, that proper and efficient main drainage must be provided so that the objections raised may be eliminated.

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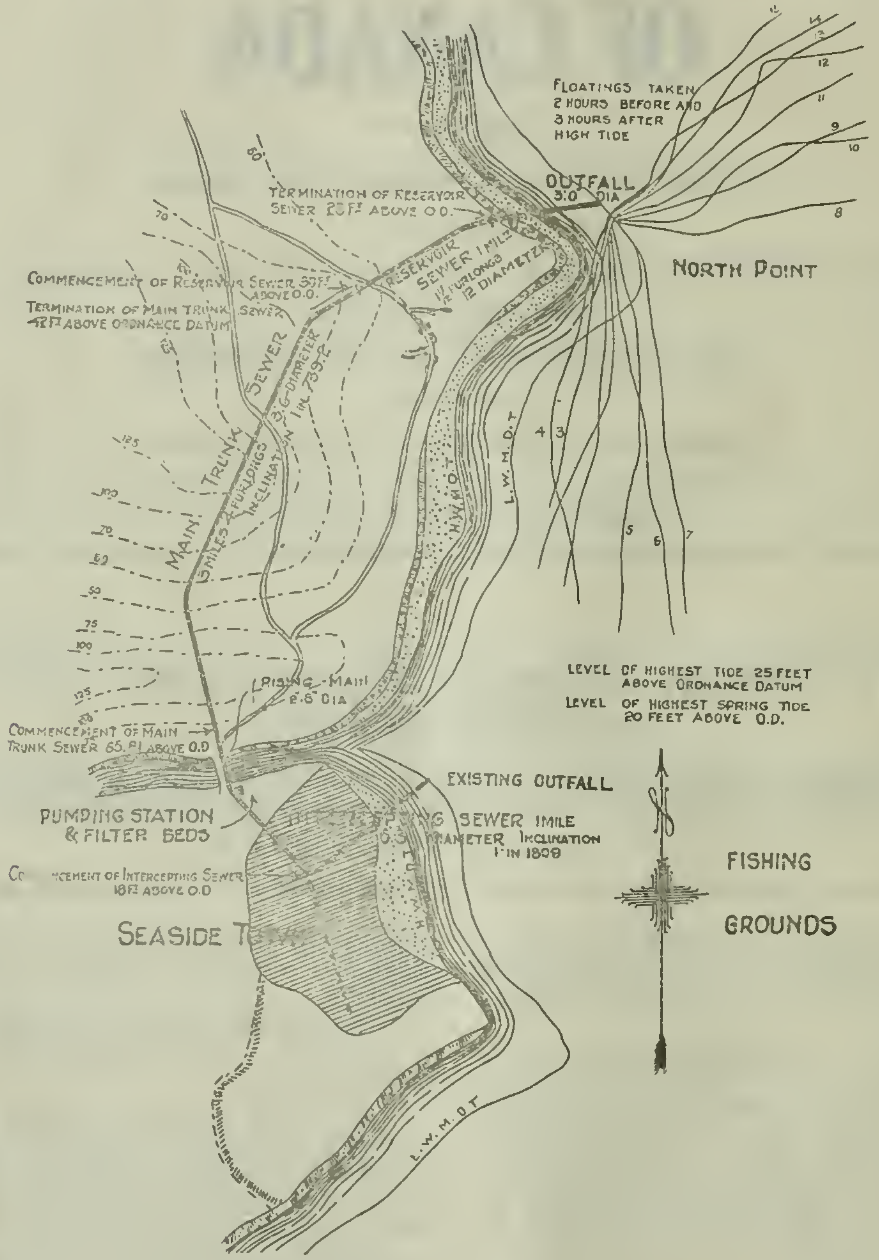
The ultimate disposal or treatment of the sewage will no doubt lead to a considerable amount of controversy, many of the faddists insisting that before discharging sewage into the sea it should be treated by means of septic tanks and bacteria filters, in spite of the fact that in order to carry their views into effect it will be necessary to construct somewhere near the town sewage works which will ultimately, no doubt, be as much cause for complaint as the objection which has brought about the necessity for the new sewage scheme.

Besides the objection of having a sewage works in or near a town, the question of annual expenditures must also be considered, together with the difficulties of disposing of the sludge.

In the case of inland towns these objections are unavoidable, but where sewage can be discharged direct into the sea without incurring a too heavy expenditure in taking the outfall sewer to a suitable point there should be no hesitation in adopting this method of disposal.


FLOATINGS TAKEN 2 HOURS BEFORE AND 3 HOURS AFTER HIGH TIDE
OUTFALL 3.0 DIA
NORTH POINT
TERMINATION OF RESERVOIR SEWER 23 FT ABOVE O.D.
RESERVOIR SEWER 1 MILE 1½ FURLONGS 12 DIAMETER
COMMENCEMENT OF RESERVOIR SEWER 39 FT ABOVE O.D.
TERMINATION OF MAIN TRUNK SEWER 42 FT ABOVE ORDNANCE DATUM
MAIN TRUNK SEWER 3 MILES 2 FURLONGS 3.6 DIAMETER INCLINATION 1 IN 739.2
H.W.M.O.T.
L.W.M.O.T.
RISING MAIN 2.6 DIA
LEVEL OF HIGHEST TIDE 25 FEET ABOVE ORDNANCE DATUM
LEVEL OF HIGHEST SPRING TIDE 20 FEET ABOVE O.D.
COMMENCEMENT OF MAIN TRUNK SEWER 65.8 ABOVE O.D
EXISTING OUTFALL
PUMPING STATION & FILTER BEDS
SEWER 1 MILE DIAMETER INCLINATION 1 IN 1809
COMMENCEMENT OF INTERCEPTING SEWER 18 FT ABOVE O.D
FISHING GROUNDS
SEASIDE T
N
L.W.M.O.T.
1
2
3
4
5
6
7
8
9
10
11
12
13
14
80
70
125
100
75
50

Map of Seaside Town.

The main principles of the scheme designed upon these lines will be to:—

(a) Convey the whole of the sewage and storm water by means of an intercepting sewer to a pumping station on the banks of the river.

(b) Pump a certain number of volumes of the dry-weather flow to a trunk sewer, through which it will flow by gravitation to the outfall.

(c) Pump a further quantity of storm water to be filtered through screening beds before discharge into the tidal estuary.

(d) Provide storm-water overflow to take excessive quantities of storm water direct into the tidal estuary.

The points to be considered in designing the scheme are:—

(1) The most suitable point of discharge into the sea.

(2) The period during which such discharge shall take place.

(3) The most suitable point for pumping.

(4) The route to be taken by the sewer.

(5) The quantity of dry-weather flow and storm water to be discharged.

(6) The size, inclination, and shape of sewers.

(7) The storage and discharging capacity of the main trunk sewer.

(8) The area of filter-beds for screening and filtering storm water.

(9) The pumping plant required.

Point of Discharge into Sea.

From a survey of the foreshore and the surrounding country it will be seen that the North point suggests itself as being the most suitable place of discharge for the new sewer, but before definitely deciding floating operations will have to be carried out to ascertain the direction and flow of the currents.

The floating operations should extend over a month in order to get reliable records of the currents at all states of the tide, including every height from one highest spring tide to another.

The best method of determining the direction of the currents is by means of a sextant in a small boat, the floats being of timber 6 in. by 4 in. about 3 ft. long and weighted at the bottom so that they project about 12 in. above the water, the top painted bright red.

At the commencement of each operation the float should be dropped into the water at a selected point, and, with a sextant, angles should be taken nearly simultaneously to three defined points on the land. In order to take the angles in rapid succession it is best to use three sextants and to read the angles afterwards.

The simplest method of plotting the various observations on a plan is to draw three lines on tracing paper, including the two angles subtended by lines joining the points on shore, the third angle being a check angle. Then move the tracing paper about on the plan until the three points are exactly covered by the three lines. The points from which the three lines radiate will be the required station.

The velocity of the currents can be estimated by observing the time taken by the floats to traverse the distance between stations and measuring the distances from the plan after plotting.

The Period of Discharge

From the direction of the currents shown upon the plan it will be seen that those numbered from 8 to 15 are such as will carry and discharge the sewage from two hours before and three hours after high tide direct out to sea. The currents shown by lines 1 to 7 show a tendency to hug the foreshore, and any discharge of sewage at similar times and state of the tide would probably lead to further objections and complaints, both from the bathers and from the proprietors of the fishing grounds.

The best time, therefore, for the discharge of sewage will be (according to the time and direction of the currents) during the period of two hours before high tide and three hours afterwards, or a total of ten hours out of twenty-four during which discharge can take place.

To Ascertain if Pumping is Necessary

In order to fix the level of the invert at the commencement of the intercepting sewer, it will be necessary to ascertain the level of the lowest point of the district to be drained. It will also be necessary to ascertain the level of the existing outfall sewer. It is assumed that the invert of the new sewer at its commencement might be fixed at 18.00 ft. above ordnance datum.

It will be observed that the highest tide is 25.00 ft. above ordnance datum, but as this only occasionally happens, and the highest spring tide is 20.00 ft. above ordnance datum, the level of the outlet of main trunk sewer might reasonably be fixed at 23.00 ft. above ordnance datum.

It will therefore be seen that in order to drain the lowest part of the district, to intercept the existing outfall sewer, and to discharge at the point selected, pumping will be necessary.

Suitable Site for Pumping

The most suitable site for a pumping station is the next point for consideration, and as there flows past the town a river into which storm water can be discharged it is desirable that the pumping station should be somewhere near its banks.

The points which will have to be taken into consideration when fixing its exact location are:—

(a) That sufficient land is available for filtering the storm water before discharge into the tidal estuary.

(b) Whether there is a bridge across the river upon which the rising main can be carried.

It has been assumed that land with the above two requirements is available, and can be purchased for the purpose.

The point and level of commencement of the intercepting sewer, the position of the pumping station, and the exact point of discharge into the sea having been decided upon, the next important consideration is the route of the main trunk sewer.

Route of Main Trunk Sewer

In order to fix a route it will be necessary that a contoured survey of the surrounding country should be made, and from the information thus obtained the engineer will be able to decide.

(a) In which direction the sewer shall be taken to lessen deep cuttings or high embankments;

(b) Whether it would be cheaper to tunnel rather than make a wide detour.

These two points are most important, as through an injudicious decision a considerable amount of money may be wasted. It will be seen, upon studying the plan and levels, that the ground rises sharply on the North bank of the river, and by pumping up to a height of 67.00 ft. above ordnance datum (ascertained as shown later), the new main sewer can be designed so that the sewage will flow by gravitation to the outfall.

By carefully considering the contour of the ground, it will be seen that the route selected will necessitate only a small length of embankment, and that it would be cheaper to tunnel than to make a wide detour.

Quantity of Sewage and Storm Water

Before designing the size of the new sewers it will be necessary to calculate:—

(1) The present dry-weather flow.

(2) The present population.

(3) The future increase in population, say, in sixty years' time.

(4) The total dry-weather flow for the increased population.

(5) The quantity of storm water to be dealt with.

(6) The total storm and dry-weather flow to be provided for (in cubic feet per minute).

(7) The maximum quantity of sewage to be stored and discharged at the outfall after allowing for discharge of storm water.

To Ascertain Dry-Weather Flow per Head of Population.

The dry-weather flow of the present population can be obtained by taking gaugings between two manholes at the existing outfall during dry weather. The method usually adopted is by noting the time floats take to travel between two manholes and booking the hydraulic mean depth at regular intervals, say every half hour, and afterwards working out the results in the office by means of the following formulæ:—

$$v = \frac{s}{t}$$

$$Q = Av$$

where v = velocity in feet per minute, s = distance in feet, t = time in minutes, Q = cubic feet per minute, and A = Area in feet.

To Calculate Increase in Population

The present population of the town is 65,000. In 1900 it was 55,000. The estimated population in sixty years hence can be calculated in the following manner:—

55,000 population in 1900: Log 55,000 = 4.7403627
65,000 " " 1910: Log 65,000 = 4.8129134

Difference 0.0725507

A period of 60 years being allowed.

.0725507 × 6 = .4353042
Add 4.8129134

= 5.2482176

which is the logarithm of 177100, and this figure represents the maximum population upon which the dry-weather flow is to be calculated.

Maximum Dry-Weather Flow

Assuming that as a result of the gaugings and calculations to ascertain the present dry-weather flow it is found to be 30 gallons per head per day, then the maximum dry-weather flow (in 1960) will be:—

177,100 × 30 = 5,313,000 gallons per day. As the dry-weather flow varies considerably throughout the day, it may be safely assumed that one-half will be discharged in six hours i.e. 7,379 gallons per minute, equal to 1,180 cub. ft. per minute.

Maximum Quantity of Storm Water

The next important consideration is the quantity of storm water which is likely to reach the sewer per minute, the factors governing the calculation being:—

(1) The maximum rainfall.

(2) The area to be drained.

(3) The rate at which it will reach the sewers.

To ascertain the maximum rainfall a study of past records should be made.

For the purpose of designing the scheme under consideration a rainfall of 1 in. in one hour has been taken, but in order to safeguard against flooding in cases of exceptional storms a relief out-fall to the river is provided.

The present area to be drained is approximately 900 acres, and assuming the area which the population for the next sixty years will cover as being one and a quarter times the area per head of present population (having regard to town planning ideas), the total area to be taken into consideration will be 3,065 acres, say 3,000 acres. As the greatest proportion of the area when built upon will be paved, the total quantity of water that reaches the sewers will amount to about 75 per cent of the rainfall; therefore, in calculating the quantity of storm water to be dealt with, 2,250 acres might be taken as the area.

The rate of flow to the sewers can best be calculated by the Burkli-Ziegler formulæ — i.e.:—

$$Q = Rc\sqrt[4]{\frac{S}{A}}$$

where Q = cubic feet per second per acre reaching sewers.

R = average rate of rainfall during heaviest fall in cubic feet per acre = 1 cub. ft. per acre per second for an 1-in. rainfall per hour.

c = a constant = .75 for paved streets and .31 for macadamised streets.

S = general fall of area per 1,000 ft.

A = drainage area in acres.

$$Q = Rc\sqrt[4]{\frac{S}{A}}$$

$$= 1 \times .5 = \sqrt[4]{\frac{2.2}{2250}}$$

$$= .5 \times \sqrt[4]{.00098}$$

$$\text{Log. } .00098 = \bar{4}.9912261.$$

$$\text{Divide by } 4 = \bar{1}.2478065.$$

$$= .17693$$

$$= .5 \times .17693$$

$$= .088465 \text{ of a cub. ft. per sec. per acre.}$$

The total rainfall reaching the sewer per minute = $.088465 \times 60 \times 2250 = 11942$ cub. ft.

Storm water......11,942 cub. ft. per minute.
Dry weather flow. 1,180 " "

Total flow......13,122 " "

The Maximum Quantity of Sewage to be Discharged by Main Trunk Sewer

In order that the annual expenses of pumping dry-weather-flow sewage to main trunk sewer shall be kept as low as possible, it is necessary carefully to consider by how many volumes it should be diluted before the excess flow is passed on to the filter beds and thence to the river. There is a great divergence of opinion as to the degree of pollution before discharging either on to screening beds or direct to a river, but the basis originally laid down by the Local Government Board of Great Britain, and recently confirmed by the fifth report of the Royal Commission is generally acted upon — that is, that three times the normal dry-weather flow must be treated as ordinary sewage, and a further three volumes must be treated by passing through separate storm-water filter-beds or screening beds before discharging into river or stream. Any excess of this amount may be discharged direct.

The first rush of storm water in sewers is usually very foul, owing to all sediment, etc., being washed along by the excessive flow, but ultimately only the normal dry-weather flow and storm water is discharged. This state of things is probably reached when the flow is three times the normal dry-weather flow, but if the latter is at its maximum, the dry-weather flow will probably only be diluted by about two volumes, so that further treatment is necessary before discharging direct into the river. If a storm should take place during the period when the dry-weather flow is small, say at midnight, the degree of dilution will be so high after three volumes of normal dry-weather flow have been discharged that no further treatment should be required.

It is difficult to define exactly the maximum and minimum periods of dry-weather flow discharge, so that the normal dry-weather flow will be taken for the purpose of designing this scheme.

If four times the normal dry-weather flow is discharged direct into the sea through the main trunk sewer, a dilution of two and a half to three times the maximum dry-weather flow will be obtained, or six to five and a half times the minimum dry-weather flow.

The normal dry-weather flow has already been found to equal 30 gallons per head per day, so that the maximum quantity of sewage which the main trunk sewer will have to take when the population is 177,100 — i.e., in sixty years' times — will be $177,100 \times 30 = 5,313,000$ gallons per day, or $590 \times 4 = 2,360$ cub. ft. per minute.

Storage Capacity of Reservoir Sewer

From observation of the currents it has been found that discharge can take place for five hours — i.e., two hours before and three hours after high tide — so that it will be necessary to provide storage capacity for seven hours. The flow of 2,360 cub. ft. per minute — i.e. four times the normal dry-weather flow — is not likely to be maintained throughout the whole seven hours, and ample provision would be made if 75 per cent of this amount were taken. The quantity then to be stored for seven hours would be:—

$$\frac{2360 \times 60 \times 7 \times 75}{100} = 743,400 \text{ cub. ft.}$$

or a little over 4,500,000 gallons, which must be discharged in five hours.

Arrangements should, of course, be made that, if at any time the storage capacity is insufficient, the stored sewage could overflow and empty into the sea.

The Size, Shape, and Inclination of Sewers

The size, shape, and inclination of sewers should next be settled.

The sizes of sewers are ascertained from the formulæ $Q = A\,v$ and $v = c\sqrt{rs}$, where Q = quantity discharged in cubic feet per minute.

a = area of sewer in feet.
v = velocity in feet per minute.
c = a variable coefficient.
s = the sine of the slope, and
r = hydraulic mean depth.

The value of c varies with different sizes of channel, but for the sizes of sewers which will be required in this scheme it can be taken as 118.

In respect to the minimum velocity which should be allowed, it has been found that a bottom velocity of 1 ft. per second will move fine gravel the size of peas, and 2 ft. per second will move rounded pebbles about 1 in. in diameter. The velocity of sewage varies at different depths, the least, mean, and maximum being in proportion to 3, 4 and 5.

It has been found from observation that the following mean velocities should be obtained in order to keep the sewer self-cleansing:—

2½ ft. per second for sewers over 24 in.
3 ft. " " 24 in. to 12 in.
and 3½ ft. " " under 12 in.

The maximum velocity which should be allowed is a debatable point with most authorities on main drainage, but a velocity of 5 to 6 ft. can be allowed, provided the sewers have been constructed in a good, workmanlike manner.

Shape of Sewers

For such sewers as are required in a scheme of this description, in which a large volume of sewage is to be conveyed, the shape which is most suitable is undoubtedly that of a circular section, for the following reasons:—

(1) It is most economical in construction.

(2) Simplicity of design.

(3) Great strength is obtained.

For the ordinary sewers which have a fluctuating flow the egg-shaped section has a decided advantage over the circular section, as with a small volume of sewage a higher velocity of flow is obtained owing to the greater depth of flow.

As the scheme under consideration only deals with large flows of sewage, the circular section has been adopted throughout.

As to the general method of constructing the sewers, it has been found from experience that brickwork is the most suitable for sewers in tunnel, both on the grounds of economy and good workmanship. In open cutting, concrete or reinforced concrete can be used with advantage, as the concrete can be mixed and put in position without much labour, and in the latter method of construction the work can be better supervised than in the tunnel work.

The principal factors governing the general design of the scheme having been decided, the next step is to consider the size of the sewer which intercepts the sewage flowing down the existing outfall sewer, and is to convey it to the pumping station. The lowest level of the district which has to be drained is 25 ft. above ordnance datum, but in order to intercept the sewage conveyed down the existing outfall sewer the level of the commencement of the new intercepting sewer has been fixed at 18.00 ft. above ordnance datum. The quantity of sewage and storm water which this sewer will have to discharge is 13,122 cub. ft. per minute.

To find the diameter of the sewer large enough to discharge this quantity of sewage per minute, the length of the sewer being one mile, and allowing a velocity of 4 ft. per second, proceed as follows by means of the formulæ —

$$Q = A\,v$$

$$Q = \frac{\pi d^2}{4} \times v$$

$$13122 = \frac{3.1416 \times \pi d^2}{4} \times 240$$

$$8.35 = d$$

Say 8 ft. 3 in. as the diameter of the sewer.

To find the inclination —

$v = 118\sqrt{r \times s}$ H.M.D. of circular sewer $-\frac{d}{4}$

$$4 = 118 = \sqrt{\frac{8.25}{4} \times \frac{H}{L}}$$

H = fall in sewer

L = length of sewer.

$$4 = 118 = \sqrt{\frac{8.25}{4} \times \frac{H}{5280}}$$

$$4 \times \frac{50.6}{118} = \sqrt{H}$$

$$H = 2.92$$

The fall in the intercepting sewer would therefore be 2.92 ft. in 1 mile, or 1 in 1,809.

New Main Trunk Sewer and Reservoir Sewer

It has already been stated that the most convenient level of the termination of this sewer is 23.00 ft. above ordnance datum, and in order to minimise the cost of construction as much as possible this sewer should be kept near the surface, in order to obviate deep cutting.

The quantity of sewage to be stored has been calculated at about 4,500,000 gallons. Assuming a diameter of 12 ft. for the reservoir sewer its length can be found as follows:—

Gallons to be stored		Length of reservoir sewer		Area of reservoir sewer		Gals. per cub. foot
4,500,000	=	L	×	113.10	×	6.25
6,366 ft.	=	L.				

The length of reservoir sewer with a diameter of 12 ft. will therefore be a little over 1 mile 1½ furlongs.

The invert level of the reservoir sewer at its commencement should now de decided.

It will be desirable to keep the invert of the trunk sewer above the crown of the reservoir, if possible, in order to obviate "backing up" during the interval of storage, and also for future extension it will be easier to extend the reservoir sewer if it is kept below the trunk sewer.

The level of the reservoir sewer at its termination being fixed at 23.00 ft. above ordnance datum, if a fall of 7 ft. is given in a length of 1 mile 1½ furlongs, an inclination of 1 in 891 is obtained, with an invert level of 30.00 ft. above ordnance datum at the commencement of the reservoir sewer. As the ground level at the junction of the trunk sewer and reservoir sewer is 52 ft. above ordnance datum there will be 8.88 ft. of cover, allowing 13½ in. for the thickness of the reservoir sewer at this point.

The requirements of the trunk sewer should now be considered. That factors governing its design are:—

(1) It should be capable of discharging 2,360 ft. per minute.

(2) The inclination should be such as will allow a velocity of 3 ft. to 4 ft. per second.

To ascertain diameter use same formulæ as before:—

$$Q = A\,v$$

$$Q = \frac{\pi d^2}{4}\,v$$

$$d = \sqrt{\frac{2{,}360 \times 4}{3.1416 \times 240}}$$

$$d = 3'\,6''$$

The diameter of this sewer would therefore be 3 ft. 6 in.

The fall in the sewer will be found by the formulæ—

$$v = 118\sqrt{r \times s}$$

$$4 = 118\sqrt{\frac{350}{4} \times \frac{H}{18480}}$$

$$4.88 = \sqrt{H}$$

$$25.00 = H$$

$\therefore$ The inclination will be $\frac{18480}{25.00} = 1$ in. 739.2

The inclination having been obtained, the levels of the main trunk sewer at its commencement and termination where it joins the reservoir sewer can be fixed. The level of the commencement of the reservoir sewer being fixed at 30.00 ft. above ordnance datum, and as it is desired to keep this sewer wholly below the main trunk sewer, the level of the latter will be 30.00 + 12.00 = 42.00 ft. above ordnance datum. As there is a rise of 25.00 ft. in the main trunk sewer, the level at its commencement will be 67.00 ft. above ordnance datum, which will give a cover of 3.50 ft.

Outfall

From the termination of the reservoir sewer it is proposed to take an iron pipe to terminate at low-water mark. The outlet, therefore, from the reservoir will be in the nature of a submerged orifice, and in order to calculate its size it will be first necessary to determine the average head under which it will discharge the stored sewage in five hours. When the reservoir sewer is full the maximum head would be 42.00 ft. above ordnance datum, and as the highest spring tide is 20.00 ft. above ordnance datum, this would give a working head at the commencement of 22.00 ft.; at the termination of five hours the tide would have fallen practically to ordnance datum, and as the sewer will be nearly empty at that time a mean head of 22.50 is obtained.

The quantity of sewage to be discharged in the five hours will be 4,500,000 gallons in the reservoir plus the discharge of the main trunk sewer for that period. It is not at all probable that the trunk sewer will be discharging full bore during the seven hours in which the reservoir is being filled as well as for the five hours during which the latter is being discharged; it is therefore safe to assume that for the period of five hours it would not be discharging more than half its capacity, which will bring the total quantity of sewage to be discharged to about 6,750,000 gallons, or 3,600 cub. ft. per minute.

To find the size of the pipe necessary to discharge at this rate, the best formula to use is that of Eytelwein—

i.e., $D = .53\sqrt[5]{\frac{LW^2}{H}}$ where D = diameter of pipe in inches

L = length of pipe in feet,
W = quantity discharged in cubic feet per minute,
H = head in feet.

$$D = .53\sqrt[5]{2200 \times \frac{3600 \times 3600}{22.50}}$$

$$.53\sqrt[5]{1267200000}$$

Log. 1267200000 = 9.1028452
Divide by 5 = 1.8205690
1.8205690 = the log. of 66.156
D = .53 × 66.156
= 35.06 in.

A pipe 3 ft. in diameter would therefore be of sufficient size for all requirements.

At the end of the storage reservoir a penstock would be constructed, and in order to obviate any difficulty in the event of a penstock getting out of order it will be advisable to arrange a duplicate outlet with duplicate valves.

Screening Beds

Arrangements have already been made whereby four times the normal dry-weather flow will be pumped to the main trunk sewer, to flow by gravitation to the reservoir sewer and outfall. It has been previously pointed out that if a storm takes place when the dry-weather flow is at its maximum, the normal dry-weather flow is only diluted by 2½ to 3 volumes when the required quantity has been pumped to the main trunk sewer, so that further treatment of some sort is required before direct discharge to the river is allowed. It is therefore proposed to pass through rough storm water screening beds up to eight times the normal dry-weather flow before discharging direct into the tidal estuary. This will allow a dilution of about six times the maximum dry-weather flow or ten times the minimum dry-weather flow before direct discharge takes place. By such an arrangement it is estimated that only storm water will be discharged direct into the tidal estuary.

The quantity of storm water to be passed through the screening beds will be the difference between four and eight volumes of the normal dry-weather flow—i.e., 4,720—2,360 = 2,360 cub. ft. or 14,750 gallons per minute.

Allowing a filtration of 500 gallons per square yard per twenty-four hours, the area of the filters required at present will be 6¾ acres.

Pumping Plant

It is not necessary to design the pumping plant at present so that it shall be sufficient to deal with the flow when the district is fully developed, and, as in the case of the screening beds, only half the maximum flow is taken into consideration.

The quantity of sewage diluted by four volumes which is to be raised from the pump will be for the present 1,180 cub. ft. per minute. The total height from the bottom of the pump to the crown of the trunk sewer will be 60 ft. plus the loss of head due to friction in the rising main.

The area of the rising main, allowing a velocity of discharge from the pumps of 240 ft. per minute, will be $\frac{1180}{240} = 4.91$ sq. ft., or a diameter of 2 ft. 6 in.

The loss of head due to friction can be found as follows: —

$$V = 100\sqrt{V \times \frac{H}{L.}}$$

$$4 = 100\sqrt{.62 \times \frac{H}{1100}}$$

$$4 = 2.3\sqrt{H}$$

$$2.99 = H$$

That is, 2.99 ft. of head is required to overcome the friction in 1,100 ft. of 2 ft. 6 in. pipe when discharging 1,180 ft. per minute. An allowance of 4 ft. should therefore be made for loss of head due to friction, including that due to bends, which will give a total head to pump against of 64 ft. therefore 1,180×62.5×64 = 4,720,000 ft.-lb. per minute = 143 horse power (actual). With an efficiency of 70 per cent the required indicated horse power will be —

$$\frac{143 \times 100}{70} = 204.28 \text{ I.H.P.}$$

In order best to deal with the intermittent flow of sewage during dry and wet weather, when the normal flow of sewage is diluted up to four volumes, it will be advisable to have two pumps of 110 I.H.P. each, with two pumps of similar power in reserve. This arrangement will be sufficient for the demands of the near future, and if electricity is used for the motive power arrangements can be made by means of floats whereby the pumps can be brought into action automatically as required.

Additional pumping plant will be required to deal with the flow of sewage and storm water in times of heavy storms, in excess of four times the normal dry-weather flow. The indicated power of these pumps can be calculated in the same way as before; but as the storm water will be either discharged on to the screening beds or direct to the river, the lift will only be about 20 ft.

The best arrangement for ensuring that ten times the dry-weather flow will be passed on to the screening beds before direct discharge into the river will be to arrange that the delivery from the pumps discharge into a channel (leading to the beds) with an adjustable weir, so that when the flow exceeds ten times the normal dry-weather flow the storm water will flow over the weir into another channel, which will convey it to the river direct.

It has already been stated that the pumps have been designed for the needs of the immediate future, so that as the town further develops the pumping capacity can be increased accordingly.

Cost — Plus Contracts[*]

An explanation of the differences between the cost plus and unit price form of contract, advantages and disadvantages, with examples of contracts on the cost-plus basis.

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Cost-plus contracts as here discussed, embrace only those on cost-plus-a-sliding-scale-fee. They are not new but unusual circumstances through which we have just passed and which still prevail, rendered them desirable if not absolutely necessary. They are largely the child of unsettled conditions, both as to materials and labour, which have obtained during the past five years. More particularly was this true near large industrial centres where labour, both skilled and unskilled, was at a premium, and where the labour turnover on works both large and small, was very high. This fact coupled with uncertain deliveries due to underproduction and uncertain transportation increased the contractor's hazard to such an extent that the execution of any contract as expected was largely subject to forces over which he had no control. There were two alternatives, one that he should protect himself by an unreasonably high bid which would be unfair to the owner should anticipated possibilities not materialize, the other that some form of agreement be entered into by which the contractor would be assured a fair return for his organizing and supervising ability and which in addition, would make him a profit sharing partner in every dollar he saved his client.

Theoretically, a competitive system is desirable. It invites the keenest competition, the reward going to the lowest responsible bidder. Incompetent labour has no place in the organization and if the contract has been drawn by competent parties, the owner knows the outside cost of the work and can finance accordingly. The owner, however, is not the only party to the contract and there are other interests to be served and safe-guarded, as well. Under the old system of lump sum or unit price contract, the contractor assumed all the risk and not infrequently the owner received something for which he did not pay and the contractor paid for something for which, from his standpoint "value received" could not always be written. The full power of the law is used in the suppression of gambling practices but it has so far failed to take cognizance of this element in the lump sum contract. The lump sum contract has been practically an insurance policy that the cost of any structure would not exceed a definite fixed amount. The friction which so often arises in a lump sum contract which all too frequently ends in litigation, is an indication that some essential is lacking. On the engineer must fall the full burden of fair interpretation, and he is neither a Daniel nor a Solomon. Any method, then, which is equitable and which keeps the contractor, the engineer and the owner in harmony must have some justification for its existence. The cost-plus contract furnishes an ideally correct medium for meeting these conditions.

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The contract which covered every possible contingency has probably not yet been drawn. When that stage of perfection is reached, we shall probably be so near the millennium that the brotherhood of man will render a contract of any type unnecessary. The cost-plus contract falls far short of perfection inasmuch as it has disadvantages, but in this respect it does not suffer in comparison with the unit price contract. Each has its virtues and they must all have due consideration. Arguments for and against the cost plus systems may be briefly summarized:

Advantages and Disadvantages

For:—

(1) Owner and contractor co-operate in a common interest.
(2) The owner does not pay for a contracting risk which does not materialize.
(3) There is no incentive to skimp work.
(4) Flexibility is provided for increasing or decreasing quantities or type of construction. The question of extras never presents a problem.
(5) Construction may be begun before plans are complete.
(6) Equitable settlements are effected in harmony.

Against:—

(1) Excess cost and inability to finance may close down work.
(2) If the contractor has work under both types of contract, the competent labour goes to the unit price job.
(3) The engineer may be less thorough in preparation of plans or in supervision due to time required in checking accounts.
(4) Unscrupulous contractors and engineers may profit at the expense of the owner.
(5) Legal status not finally determined.

For many years much construction has been carried on by railroads and large corporations on the cost-plus basis. The reputation of their contractor for efficiency and integrity was well known to them, and as a rule that confidence was seldom misplaced. Prior to 1915, very little reference to this type of contract was made in the technical press, although it had been in vogue in Europe for some time. Two contracts before that time covered the construction of the Cambridge subway for the Boston Elevated Railway, and a macadam road for the Troy Public Works Company at Utica, N.Y. In 1916, the United States Government called for tenders for repairing dock buildings under this type of contract, and it was alleged that the only other proposal of this character in recent years by the U.S. Government was the Panama Canal bid in 1907.

The contract and not the specification is the outstanding factor in the cost-plus system. The basic principle is the owner's confidence in the contractors established reputation for efficiency and integrity. All that a contractor has to sell at any time is service, and to be considered efficient he must do his work better than the next man and at less cost. In answer to a question as to the relative efficiency of labour, on cost-plus or lump sum contracts, the president of the Turner Construction Company said in part "In a properly organized construction company, there is no difference in efficiency in labour engaged on percentage work as compared with lump sum work. A workman is naturally primarily interested in his own welfare and hence in the keeping of his job. When he knows that diligence on a percentage job is rewarded by continuous employment, he will work just as hard on one type of contract as on another."

Cost-plus contracts in addition to the customary construction specifications and schedule of quantities, generally include a list of plant, apart from tools, which will be required upon the work and for which a fair local per diem rental is specified for each unit. A schedule of wages covering skilled and unskilled labour is incorporated and may not be exceeded without the owner's consent. A statement of the value of the plant may be required of the contractor, and it is sometimes specified that the plant may be taken over by the owner at this valuation less rental paid, it being maintained by the owner throughout the work. The plant rental may be a lump sum, in which case the owner knows that undue prolongation of the work will not increase this particular item of cost. In some instances, it is desirable that the contractor should maintain the plant at his own expense throughout the work.

Cost Factors

The direct cost of the work is financed by the owner upon submission of statements by the engineer covering obligations properly incurred in the work within the following descriptions:—

(1) All materials, tools and supplies, but not equipment included in the rental schedules.
(2) All wages in accordance with approved schedules expended directly or incident to the work.
(3) Payments to sub-contractors properly made.
(4) Plant rental.
(5) Loading and unloading of plant and replacements therein.
(6) Transportation and expense of field force.
(7) Bond fees, royalties and incidental expenses.

The actual cost of the work is the sum total of all the statements certified by the engineer and paid by the owner. If there is any difference in the final quantities to those which were given in the schedule forming part of the contract, an adjusted estimate has to be made by multiplying the various unit costs submitted by the contractor in his bid by the quantities certified by the engineer to have been incorporated in the work. The nominal profit is fixed in the contract as some definite percentage of the adjusted estimate. The actual profit of the contractor is based on the difference between the actual cost and the adjusted estimate. If the actual cost of the work is the same as the adjusted estimate, the nominal profit is the actual profit paid to the contractor. Such a circumstance is seldom, if ever, likely to occur and the ways in which the adjusted profit may be determined are so varied that several typical examples are given herewith.

Adjusted Profit

A contract for the construction of a sewer for the Essex Border Utilities Commission paid the contractor a nominal profit of ten per cent of his estimate. If the actual cost was more than the adjusted estimate, ten per cent was paid by the contractor and ninety per cent by the Commission. If the actual cost was less than the estimate, ten per cent of the difference was paid to the Contractor in addition to the nominal profit. This is not an unusual type of contract, but existing case percentages might be increased to twenty or even fifty per cent and the base fee to fifteen or twenty per cent on small contracts.

The North Jersey Water Supply Commission provided for an adjustment to certain labour costs after 1920, provided such costs were 10% above or below normal 1920 prices. This placed the burden of change in material costs on the contractor but caused the owner to share unusual changes in labour cost. Careful supervision and economical construction methods were thus required of the contractor as in unit price contracts without asking him to assume all responsibility for labour changes. Even this departure from standard Government contracts did not meet with success, and in October new tenders were called on a straight cost-plus basis in the hope of securing lower figures.

The Miami Conservancy Commission after a long and favorable acquaintance with a certain contractor awarded a contract on the following basis:—

"The contractor's fee to be 9% of the base price. If construction cost exceeds the base price, the contractors fee shall be reduced by 25% of the excess cost up to an excess of 10% and 50% of any additional cost above 10% of said base price, provided, however, that the contractor's fee shall not be reduced to less than 4% of said prices. Should the actual construction cost be less than the base price, the contractor's fee shall be increased by 25% of the saving in cost below the base price up to a saving of 10% below the base price and by 50% of all additional saving above 10% of said base price. This contract carried with it the unusual clause that it could be terminated at once on the disability of the president of the company. His presence was the essence of the contract."

In a paper presented to the American Society of Civil Engineers, J. A. L. Waddell, consulting engineer of New York, outlined a contract in which owner, contractor, and employee were all considered, and had a definite share in the final adjustment of profit. This had much to commend it and deserves more than passing mention.

In July, 1918, the Essex Border Utilities Commission called for tenders for the construction of an intercepting sewer. This was a straight unit price contract, the contractor furnishing all materials and labour. He was also under heavy bond for its completion and subject to a time penalty clause. Owing to the excessively high bids received, tenders were called a month later on a cost-plus basis. There was no change in the specifications or in the amount of work to be done. The contract was changed sufficiently to meet the conditions on a cost-plus basis and the profit was determined as follows:

Comparison of Bids and Settlement Figures

Item No.	Description	Unit	Unit Cost		Total Cost	
			Unit Price	Cost Plus	Unit Price	Cost Plus
1	Exc. to 8 ft. depth	10 cu. yd.	2.00	2.00	20.00	20.00
2	Exc. 8 to 12 ft. depth	540 " "	3.00	2.00	1620.00	1080.00
3	Exc. 12 to 18 ft. depth	12000 " "	3.10	1.50	37,200.00	18,000.00
4	Exc. 18 to 24 ft. depth	21300 " "	3.30	1.85	70,290.00	39,405.00
5	Exc. over 24 ft.	10 " "	4.00	2.00	40.00	20.00
6	15" V.T.P.	1060 lin. ft.	1.10	1.00	1,166.00	1,060.00
7	18" V.T.P.	1310 " "	1.50	1.40	1,965.00	1,834.00
8	20" V.T.P.	1530 " "	2.20	1.70	3,366.00	2,601.00
9	24" V.T.P.	2540 " "	3.15	2.60	8,001.00	6,604.00
10	27" concrete pipe	1960 " "	3.00	2.65	5,880.00	5,194.00
11	33" rein. con. pipe	3640 " "	3.80	3.25	13,832.00	11,830.00
12	4' Diam. M.H.	410 Vert. ft.	8.00	6.00	3,280.00	2,460.00
13	4' 6" Diam. M.H.	410 " "	9.00	6.50	3,690.00	2,665.00
14	M.H. frames covers	48 Sets	20.50	15.00	984.00	720.00
15	M.H. steps	644 steps	1.00	.70	644.00	450.00
16	20" force main	165 lin. ft.	3.00	3.00	495.00	495.00
17	20" " " under track	64 " "	22.00	15.00	1,408.00	960.00
18	Ford meas. chamber				3,200.00	1,800.00
19	Walkerville meas. chamber				2,360.00	1,200.00
20	East main regulator				751.00	600.00
21	Relief main regulator				987.00	760.00
22	West main regulator				1,109.00	825.00
23	Drop house connections 27"	10 each	20.00	14.00	200.00	140.00
24	Drop house connections V.T.P.	55 "	19.00	14.00	1,045.00	770.00
25	Straight house connections	2 "	18.00	10.00	36.00	20.00
26	Asph. blk. pavement	720 sq. yd.	3.00	2.45	2,160.00	1,764.00
27	Con. pavement	170 " "	2.00	2.00	340.00	340.00
28	Sidewalk	2850 " "	1.80	1.50	5,130.00	4,275.00
29	Extra concrete	10 cu. yd.	18.00	10.00	180.00	100.00
30	Timber platform	10 B.M.	100.00	65.00	1,000.00	650.00
					$172,379.00	$108,642.80

"As full compensation for the services of the contractor including profit and all general overhead expense unless elsewhere provided, the commission shall pay to the contractor in the manner hereinafter prescribed, a profit to be determined from the following schedule at the time of completion of the work except as elsewhere provided. For purposes of determining the estimated cost, the unit sum bid by the contractor times the estimated quantities will be used. In the event that it is desirable to increase the work, the calculated cost on the unit bid basis will be used to determine the proportionate amount that the basic profit to the contractor shall be increased or decreased. If the actual amount of the work is less than the adjusted estimate cost, or this cost adjusted as determined above, the saving is to be divided and 25% of it paid to the contractor in addition to his profit and the remaining 75% shall become the property of the commission. If the actual cost is more than the adjusted estimate cost, the amount of such excess shall be divided and paid for as follows: — 10% by the contractor to be deducted from his profit and 90% by the commission. The profit shall be if the work cost the same amount as the adjusted estimate the sum of $12,000 and in no case shall this be reduced to a sum less than 50% of the $12,000 profit by any reductions due to the work costing more than estimated."

This sewer was constructed for its entire length along the river front and the element of risk was high. The same contractor was the low bidder in each case and a comparison of the bids and final settlement figures may be of interest.

Actual cost of work..............	$115,621.63
Contractor's estimate............	108,642.80
Excess cost....................	$ 6,978.83
Profit fee.......................	$ 12,000.00
Less 10% of excess cost..........	697.88
	$ 11,302.12

Lowest bid on lump sum tender..	$163,573.40
Cost on percentage basis....	126,923.75
Total saving..................	$ 36,649.65

In the same year, tenders were called and the contract awarded on a unit price basis for the construction of an intercepting sewer known as the South Interceptor, the contract price for which was $115,000.00. When the actual value of work done amounted to $62,460.51, the contractor made an assignment, the cost of the work to him at that date being approximately the contract price. A final settlement has not yet been made, as nearly all parties interested either directly or indirectly are involved in litigation. Early in the present year, tenders were called for the completion of this work on a cost-plus basis and it is being carried to completion very close to the contractor's estimate. In the first case, inexperience not less than financial backing courted disaster. The contractor was either unfamiliar with or did not appreciate local conditions and while highly recommended, his ability to handle work of this nature was not known to the Commission. Such a contract would not have been awarded to a comparatively unknown contractor on a cost-plus basis. These examples offer a very striking contrast of the results attained under the two types of contract.

The integrity, experience, ability and financial rating of the contractor are extremely important elements in this type of contract, probably more important than in either the unit price of lump sum contract. Construction involving the expenditure of upward of a million dollars for filtration plant and pipe lines in Ohio could have been very nicely handled on this basis this year, but we were advised when this method was under consideration, that it would not be permissable under the laws of that state. The cost-plus contract has not been adjudicated to any great extent in the courts and much greater care should be exercised in drawing this form of contract than in other types of contract which are in more common use.

Hydrated Lime---A Chemical Engineering Product*

Properties, manufacture, and use

Lucius E. Allen, M.E.I.C., M. Am. I. Ch. E.

Advance proof of Paper to be presented at the General Professional Meeting, Toronto, February 2nd and 3rd, 1921.

There has arisen of late years considerable discussion among those following the various engineering professions as to just what constituted a chemical engineer. To some the chemical engineer has appeared to have grown up in their midst as a sort of hybrid, whose growth had been so rapid that like the familiar cabbage, instead of one solid head appearing on one root, two heads appeared, in many cases both being cracked due to rapidity of growth. However it is gratifying to see that the chemical engineer is to-day filling an increasingly important place in the engineering and business world.

The chemical engineer may be defined as one who manages enterprises requiring the knowledge and application of chemistry. The development, manufacture and use of hydrated lime may well represent a typical example of what constitutes the realm of chemical engineering as applied to one of the most common and useful products of nature.

Historical Development

It is possibly difficult to state how early in the world's history lime was first produced or used, but it is safe to assume that at whatever age man first built the crude bonfire on some flat ledge of limestone, lime was first produced. The ancient Egyptians knew the art of producing lime as is evidenced by an examination of mortar used in building construction in those days. The Romans apparently more fully recognized the value of lime and calcined calcareous products and produced the so called Roman cement. The early French and English knew the process of slacking lime, and the necessity for thorough burning and slacking of the lime before using it in mortars. Old lime pits may still be found in France and England which were used to slack or "soak" the lime before being mixed into mortar.

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The modern development of the production and use of lime and hydrated lime is however of quite recent date, and can truthfully be said to have commenced with the advent of the trained chemical engineer. The mechanical processes necessary to produce a commercially high grade hydrated lime have been evolved and perfected within the last fifteen years, in fact the first modern hydrated lime plant to be built in England was shipped from Chicago about eleven years ago.

Chemical and Physical Qualities of Lime

Before considering the installation of a hydrated lime plant, a thorough investigation of the quality of the limestone and quick lime produced from this limestone should be made. Many limestones that when calcined will produce a lime suitable for ordinary building purposes will not be at all adapted for conversion into hydrated lime. Some limestones contain too high a percentage of iron to produce a commercially white hydrated lime, while others may contain flinty nodules that will not calcine or hydrate and are difficult to pulverize to the proper fineness.

Two well known reactions are involved in converting limestone into hydrated lime, namely:—

1—Limestone, plus heat drives off the carbon di-oxide contained in the limestone and produces calcium oxide, or quick lime.

2—Calcium oxide (lime) plus water chemically hydrates the lime and produces calcium hydroxide, or hydrated lime.

For purposes of a proper classification all limes are graded as follows:—

1—High calcium, not less than 90% calcium oxide,

2—Calcium, not less than 85%, nor more than 90% calcium oxide,

3—Magnesian, not less than 10% nor more than 25% magnesia,

4—High magnesian, not less than 25% magnesia.

There are doubtless more uses for a high calcium lime for chemical and industrial purposes than for a high magnesian lime, and while it may be conceded that a high magnesian lime is better adapted for plaster mortars, the many recent improvements that have been made in the methods of hydration of high calcium lime have overcome to a large extent the objections to the use of a high calcium lime for plaster mortars. The following analyses of a high calcium and a high magnesian hydrated lime are submitted as typical examples of these two classes of hydrated limes.

	High calcium hydrated lime	High magnesian hydrated lime
Siliceous residue.....	1.67%	1.08%
Iron and alumina....	0.70	0.80
Calcium oxide.......	65.85	48.40
Magnesium oxide....	1.92	34.16
Loss on ignition.....	28.20	15.30

The loss on ignition represents approximately the amount of water required to hydrate the quick lime and to convert it into a stable product in the form of a very fine white fluffy powder.

Manufacturing Process

1—Crushing

After the limestone has been properly calcined in either vertical or rotary kilns, it is cooled and then passed by suitable belt or pan conveyors to the crusher. The lime is usually crushed to such a size that it will all pass a one-half inch ring or screen. In some cases and with certain limes it is necessary to reduce the lime to a granular powder before it is hydrated. Owing to the physical character of burned lime, the ordinary gyratory or jaw crushers do not work satisfactorily, and some type of disc or pot crusher should be used.

2—Hydration

The next step in the process is the hydration or slacking of the crushed lime by the addition of the proper amount of water, the process being carried out by means of a hydrator. Hydrators may be divided into two general classes, (a) continuous hydrators and (b) batch hydrators. Both types of hydrators are extensively used, the Kritzer continuous hydrator and the Clyde batch hydrator being the two most commonly used types of hydrators.

The Kritzer continuous hydrator may be described as consisting of a series of several cylinders of varying diameters, but of equal length, mounted horizontally one above the other on a steel framework, the diameters of the cylinders increasing from top to bottom. Within each cylinder is a shaft to which are attached steel paddles which not only serve to agitate the lime continuously and bring about thorough hydration, but also act as a conveyor to push the lime forward from one cylinder to another. In operation the crushed quick lime is fed into the top cylinder, the correct amount of water being added through spray nozzles at the same time. Hydration commences immediately, the heat due to the hydration of the lime accelerating the reaction, so that the hydration takes place quickly.

The temperature in the top cylinder will vary from 80 degrees to 90 degrees Centigrade, depending largely on the chemical composition of the lime being hydrated, a high calcium lime usually producing higher temperatures than a high magnesian lime. A certain amount of steam is generated in the cylinders due to the heat of hydration and this passes up through the various cylinders and out through a stack provided on the top cylinder. The successful operation of the Kritzer continuous type of hydrator depends very largely on the careful regulation and control of the amount of water admitted to the hydrator, as too little water will produce unhydrated lime and an excess of water will produce a hydrate that is damp or wet and renders subsequent screening or grinding very difficult. The capacity of the Kritzer hydrator depends on the size and number of cylinders as well as the kind of lime to be hydrated, but will range from 4 to 6 tons per hour.

In the Clyde batch hydrator the crushed lime and water are both weighed or measured and admitted to the hydrator in batches. The Clyde hydrator consists of a steel pan about ten feet in diameter which rests on ball bearings and is made to revolve by suitable gearing. The steel pan is tightly covered with a sheet iron hood and stack. Suspended from a stationary framework within the pan is a series of steel ploughs or blades which keep the lime stirred up as the pan revolves, and also assist in discharging the lime after hydration is complete through a trap located in the center of the pan. From 1500 to 2000 pounds of lime are treated each batch, the time required being from 10 to 15 minutes for each batch.

3—Screening and Pulverizing

After hydration and discharge from the hydrator, the hydrated lime may still contain some small particles of unhydrated lime or core which it is necessary to remove entirely from the finished product by screening, or further pulverization. If screening is adopted, the hydrated lime is passed through a mechanical screen or separator, the two types most commonly used being the Newaygo separator and the Columbian screen. These separators entirely remove all unhydrated particles or core, and the tailings are either pulverized and sold as a separate product, or pulverized and returned to the hydrator for further hydration.

If it is desired to utilize the screenings, it is preferable instead of screening to pass the entire product coming from the hydrator through some form of pulverizer to reduce all coarse particles to a uniform fineness. The Raymond or Lehigh-Fuller mills are adapted for this purpose.

4—Packing and Storing Hydrated Lime

As hydrated lime is an extremely fine and fluffy powder, it is necessary to employ special machinery for packing or sacking the product. The Bates Valve bagging machine was invented and perfected for this purpose and is almost universally used for sacking hydrated lime. A special type of paper valve bag is used which is self sealing after being filled and makes a compact package weighing forty pounds net of hydrated lime. While hydrated lime is a perfectly stable product as compared to ordinary lime, it should nevertheless be stored in a dry place and if so stored will keep almost indefinitely, in fact the stability of hydrated lime is one of its most valuable features.

Mechanical Uses of Hydrated Lime

1—Waterproofing Concrete Work

Until recent years very little accurate data had been secured as to the many advantages of the use of hydrated lime in conjunction with portland cement concrete. In 1909 in a paper before the Canadian Cement Users' Association,* the writer called attention to the successful use of hydrated lime as a waterproofing agent in concrete work, and it is gratifying to note that its use has now become quite general.

The following series of tests conducted by Sandford E. Thompson, Boston, Mass., indicate the advantages of hydrated lime as a waterproofing agent:—

Concrete of 1 — 2 — 4 mixture, hydrated lime added; specimens were 4″ thick, water pressure was 80 lbs. per sq. in.

Percentage of hydrated lime	Flow in grams per minute At 14 days	At 21 days	At 28 days
0.0	5.52	2.92	1.91
2.0	9.20	2.55	1.63
4.0	2.82	1.49	0.76

In another series of tests by Mr. Thompson the specimens were concrete cubes in which iron pipes were imbedded through which the water pressure could be applied. The results were as follows:

Tests on concrete cubes in which iron pipes are imbedded, through these water pressure could be applied.

		Flow under 7 ft. head			Flow under pressure of 60 pounds per sq. inch		
Percent hydrated lime	Age in days	Duration of measured flow in hours	Flow in grams per hour	Age in days	Pressure applied before measure in hrs.	Duration of measured flow in hours	Flow in grams per hour
1—2—4 Concrete							
1	18	161	2.7	40	24	4¼	74.8
4	18	161	1.2	41	18	5	28.4
7	18	161	1.0	42	18	6¾	5.2
10	15	161	1.0	46	6	18	1.6
1—2.5—4.5 concrete							
0	30	169	1.9	45	18	6	32.5
10	29	169	0.8	49	..	11	0.0
14	29	169	0.7	50	..	27	0.0
1—3—5 concrete							
0	26	169	9.8	50	6	14	70.6
8	26	169	1.1	51	8	17	3.6
14	28	169	1.1	50	28	13	10.7
20	28	169	1.2	53	9	15	0.7

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* Modern Methods of Waterproofing Concrete.

In connection with these tests Mr. Thompson further says:—

"The cost of large waterproof concrete structures frequently may be reduced by employing leaner proportions of concrete with hydrated lime admixtures, and small structures, such as tanks, may be made more watertight. Although the character of the sand and stone used in the concrete will affect the best percentage of lime to use, the present materials are representative of average materials throughout the country so that the results should be of general application. Coarser sand would naturally require slightly larger percentages of lime, and finer sand (that is sands having a larger percentage of fine grains, which pass a sieve with 40 meshes to the linear inch) would be apt to require less lime since sands containing considerable fine material produce a more watertight concrete."

In connection with the second series of tests here shown, it may be of interest to note that Mr. Thompson used a pressure of 60 pounds per square inch, or the equivalent of about 140 feet head, which is far in excess of pressure met with in ordinary engineering practice.

The United States Bureau of Standards have also carried out an exhaustive series of tests* of various waterproofing mixtures in which the results were summarized in the following words: "This (hydrated lime) is the most efficient medium employed and resulted in an almost impermeable mortar at the two weeks test. Its value is probably due to its void-filling properties and the same results could be expected from any other finely ground inert material, such as sand, clay, etc."

As density of concrete is the prime requisite to secure permanency of concrete structures subjected to the action of sea water, hydrated lime has been found to be one of the best agents known for this purpose. European practice has very generally adopted the use of hydrated lime in all floating and fixed marine structures. In the construction of reinforced concrete oil carrying barges, in which the inner side of the concrete is exposed to the action of crude oil and the outside to that of sea water, the use of hydrated lime has been found to be very satisfactory. Dr. William Michaelis, an international authority on marine concrete, also advocates the use of hydrated lime for all marine concrete work. In the construction of large concrete tanks for the storage of water, ammonia, oil, etc. the use of hydrated lime has been found to give the best of results.

2—In Concrete Highways

With the rapidly increasing use of concrete as a material for the construction of our main highways, many problems have arisen as to its suitability and durability. Due to the excessive motor truck traffic on some of our main highways, it has become necessary to secure a very dense concrete to withstand the shock and wear of this traffic. To determine the relative value of using various percentages of hydrated lime with concrete for concrete highways, the State Highway Department of Delaware carried out a most interesting series of tests some three years ago.

It is now well established that the strength of concrete is governed very largely by the volume ratio of water to cement. It may be stated that a ratio of 0.4 of water to 1 of cement produces maximum strength, while a ratio of 2 to 1 gives very little strength. Under practical working conditions, however, it is difficult and unusual to mix and place concrete using the minimum ratio of water. If hydrated lime is added, greater workability is imparted to the concrete with a minimum ratio of water, thus securing the most effective results, and a concrete of maximum density. The results of the tests made by the Highway Department of the State of Delaware are here appended as illustrating this point:

"The specimens were 6″ x 12″ cylinders and were made at the same time the concrete was being placed upon the roadbed. A chute mixer was used. The cylinder form was filled by holding it under the chute and deflecting the flow of concrete from the road into the form. All specimens of one mixture were taken from the same batch in the mixer.

"The specimens were not tamped, but were struck off on top and then were covered in order to protect them from the rays of the sun, this being identical with the treatment given the road. After being covered for 24 hours they were buried at the side of the finished concrete road, and at the time when moist earth was thrown on the road the specimens were included under this covering. They were left in place until they were six months old and received the same treatment as the road during this period and then taken to be broken."

"As the tests were started in November, it will be seen that the specimens were subjected to the Fall, Winter and Spring periods."

"Consistency of the mixture was determined by the inspector and myself in accordance with our ideas of an ideal working consistency. The amount of water was not measured as it was not practical under the circumstances, but the same consistency was maintained during the mixing by the agreement of opinions of the man running the mixer, the inspector and myself; that is, the specimens were poured when the consistency was unanimously agreed to by the three parties as being the same as that of the previously made specimens."

At the end of the six months period, the specimens were removed to the laboratories of the Henry S. Spackman Engineering Co., of Philadelphia for breaking under compression with the following results:—

Compressive Strength

Percentage of hydrated lime based upon the weight of portland cement in the mixture.
Mixture 1—2—4

	0% lime lbs. per sq. in.	2½% lime lbs. per sq. in.	5% lime lbs. per sq. in.	7½% lime lbs. per sq. in.
	3108	2908	3596	3514
	2203	3640	4381	5092
	2529	3476	3473	4498
Avg.	2613	3341	3816	4368

In breaking under compression, it was noted by the laboratory that failure of the coarse aggregate occurred in every case.

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* U. S. Bureau of Standards Technologic Paper No. 3.

3—Plasters and Mortars

Perhaps one of the most common and general uses of hydrated lime is for plastering and building construction. Time will not permit an extended discussion of the use of hydrated lime in plasters and mortars except to refer briefly to some very interesting experimental results obtained by Prof. James S. Macgregor of Columbia University on brick mortars. He experimented with several mortars of the following compositions:—

	Mixtures — by volume			Mixtures — by weight		
No. 1	1.00	cu.ft.	portland cement	100	lbs.	portland cement
	3.00	"	sand	300	"	sand
No. 2	0.90	"	portland cement	90	"	portland cement
	0.10	"	hydrated lime	4	"	hydrated lime
	3.00	"	sand	300	"	sand
No. 3	0.85	"	portland cement	85	"	portland cement
	0.15	"	hydrated lime	6	"	hydrated lime
	3.00	"	sand	300	"	sand
No. 4	0.75	"	portland cement	75	"	portland cement
	0.25	"	hydrated lime	10	"	hydrated lime
	3.00	"	sand	300	"	sand
No. 5	0.50	"	portland cement	50	"	portland cement
	0.50	"	hydrated lime	20	"	hydrated lime
	3.00	"	sand	300	"	sand
No. 6	0.25	"	portland cement	25	"	portland cement
	0.75	"	hydrated lime	30	"	hydrated lime
	3.00	"	sand	300	"	sand
No. 7	1.00	"	hydrated lime	40	"	hydrated lime
	3.00	"	sand	300	"	sand

The specimens were in the form of columns, 8″ square and 84″ high, laid with a binder every sixth course as in ordinary work. The piers were laid up by a practical brick layer. Both hard burned face and ordinary backing brick were used. The specimens were tested in compression to destruction. The following results are the ultimate resistances, in pounds per square inch; and are the average of three specimens:

Face Brick Piers

Mix. No.	1	2	3	4	5	6	7
Age 7 days.....	2630	3080	2890	3120	2670	1945	1535
Age 28 days.....	2840	3170	3230	3470	3100	2370	1870
Age 3 months ..	2840	4435	4300	4170	3820	2720	1950

Common Brick Piers

Mix No.	1	2	3	4	5	6
Age 28 days....	1170	1189	1340	1685	1300	1032

It will be noted that all specimens laid in mortars containing hydrated lime up to 100% of the volume of portland cement content show decided increase of strength. There are three reasons for these increases as enumerated by Professor Macgregor:

First — The replacement of portland cement by hydrated lime renders a more plastic mortar which spreads easily on brick work and in consequence insures more uniform bedding and this with less care.

Second — The so-called "suction" of the brick which steals a great deal of moisture from portland cement mortars has been noted to affect lime-cement mortars to a much less degree. The addition or replacement by hydrated lime aids in the retention of moisture.

Third — Moisture which is lost due to causes cited probably leaves the mortar with an insufficient amount to completely hydrate or properly hydrate the portland cement, a condition which is largely overcome by the use of hydrated lime.

Chemical Uses of Hydrated Lime

While the purely mechanical uses of lime and hydrated lime are perhaps more familiar to the civil and mechanical engineering professions, and at first thought would be considered as consuming the greater tonnage of lime, nevertheless the greater tonnage is used by chemical manufacturers.

It would be impossible within the scope of this paper to treat of all the various uses of lime in the chemical trades and therefore only a few of the more important will be mentioned. Statistics for the year 1918 in the United States show that 26% of the chemical lime produced was used in the alkali industry; 15% in the manufacture of calcium carbide; 7% in the manufacture of acids. and 7% in the manufacture of bleaching powder, the balance being widely distributed in a variety of industries. Lime or hydrated lime is used to a greater or less extent in the following lines of manufacture: alkalies, calcium carbide, cyanamid, ammonium nitrate, bleaching powder, fertilizer, sand-lime brick, glass, ceramics, water purification, paper and pulp, sugar-paints, tanning, insecticides, illuminating gas and ammonia. There are some lines of chemical manufacture in which limestone, lime or hydrated lime may be used interchangeably with equally good results, while others require the use of lime or hydrated lime only. Hydrated lime can be manufactured that will contain minimum percentages of impurities, such as silica, alumina and iron, and for that reason if a very pure lime is desired or required in a certain process, hydrated lime is preferable to ordinary bulk lime.

It is a stable product, does not air slack, and is put up in convenient sized packages for handling. It may be of interest to state in conclusion that some of the best chemical engineering talent on this continent are now working out new uses for hydrated lime, and perfecting processes for producing the highest grade product possible; and it may be safely predicted that lime, one of the first and oldest chemical products known to civilized man, may yet become one of the most important as well as essential commodities produced by the chemical engineer.

Toronto Filtration Plant*

Details of operation slow sand and drifting sand plants, with tables of operating costs

James Milne, M.E.I.C.

Advance proof of Paper to be presented at the General Professional Meeting, Toronto, February 2nd, 1921.

At a meeting of the Society held 6th November 1913 a paper was read by F. F. Longley, A.M.E.I.C., on the Toronto Filtration plant. This paper covered the design and construction of the slow sand plant having a nominal capacity of 48 million imperial gallons, or a safe annual output of 32 million gallons per day.

(N.B.—Throughout this paper the British or Imperial Gallon will be used.)

This plant was designed in 1908 and when put in commission January 1912 was insufficient for the City's requirements as the following table will show:—

Year	Average daily consumption in million gallons	Population	Average daily consumption per capita
1908	29.25	315,000	92.8
1909	31.27	325,000	96.2
1910	35.03	360,000	97.3
1911	40.97	374,667	109
1912	47.06	417,250	113
1913	48.02	445,575	108
1914	50.30	470,144	107
1915	48.13	463,705	104
1916	49.96	460,526	108.5
1917	55.76	473,829	117
1918	62.72	489,681	128
1919	62.49	499,278	125
1920 (Estim'd	63.44	520,000	122

It will be noted that from 1909 to 1919 the average daily consumption doubled while the population increased 54%.

In 1914 it was decided to enlarge the plant, and specifications were prepared by the Department of Works for the extension. These specifications permitted all makers of mechanical filtration plants to tender. Bids were received from several well-known filter companies, together with one from the VerMehr Engineering Company. The filter tendered on by this company was the drifting sand. A demonstration plant was erected by the VerMehr Engineering Company, at considerable expense, to show the principle and utility of the drifting filter, and thorough tests were made. Technical papers have been written on this plant and the results of the tests have been published by Dr. G. G. Nasmith. The results obtained were satisfactory to the City representatives. Upon receipt of tenders that of the VerMehr Engineering Company was accepted.

Another paper has been written by William Gore, M.E.I.C., and Wm. Storrie, M.E.I.C., on the design and construction of the drifting sand plant, and published in *The Journal* of November 1919. It is not the intention to cover ground so thoroughly treated in these papers.

In December 1916 the first drifting sand filter was put in operation and in 1917 all filters were in use and all the water for the City's requirements was filtered. The slow sand plant has now been in operation for eight years and the drifting sand plant three and one-half years, and the purpose of this paper is to give an account of the operation, difficulties encountered, and the remedies adopted.

Actual costs of operation and maintenance, including administration, will be given, together with actual amounts paid for interest and sinking fund. For the purpose of equitable comparison, cost of operation and maintenance based on identical operating conditions, and equivalent construction cost, will also be submitted.

The Slow Sand Plant

Continuity of Service

Except for one month in 1912, when there was a shutdown for inspection purposes, the plant has been in continuous service.

Sand-washing

During the winter months of 1912, 1913 and 1914 no sand washing was done. The dirty sand was piled in bins around the pillars in the filter beds and extra men were engaged in the summer for sand washing and sand replacing purposes. In the winter of 1913-14, and in later years, extra men were required to remove the ice. While the filters are all covered, ice forms to a depth of about 3″, which must be removed after the filter is drained and prior to cleaning. Storing the dirty sand in the filters during the winter months was far from ideal, and in the autumn of 1914 a portable sand washer was installed, which enabled sand washing operations to be continued throughout the year. While a fairly high rate of filtration is maintained during the winter months, due to the temperature of the water ranging from about freezing point to 38° Fahr. with a bacteriological content much less than during the summer, nevertheless the filters are not what might be termed in first-class condition while the portable washer is used. In the summer months the outside washers are used.

Leakage

It has been stated that the leakage at the Toronto Filtration Plant was caused by reason of differences existing between the raw water inlet meter and the filtered effluent meters. This amounted to 8 or 10%. It was also stated that the meter at the inlet was out of adjustment; that the control apparatus placed beside it for the express purpose of determination of error of this kind had not been used, and that apparently the superintendent of the plant did not understand its use. Furthermore, when it was brought into use it apparently disclosed the error, and when the meter was adjusted, the difference disappeared.

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The facts of the case are as follows:—

The venturi inlet meter had been accepted and handed over to the City of Toronto with the plant. When discrepancy became evident, it was found that the cam in the meter was designed for another instrument, and that the meter, as it stood, did not and could not be made to register accurately throughout its range.

Turbidity

There has been no time that the turbidity has seriously affected the output although the rate of filtration of 4 to 5 million gallons per acre could not be maintained during prolonged turbid periods.

The temperature of the raw water rises in the spring, and this, together with the bacteriological and micro-organic content during this period, shortens the runs between rakings and scrapings, but the reduction should not exceed 20% of the high winter rate.

The following table gives the turbidities since the plant was put in operation:—

Year	Max.	Min.	Ave.
1912	163	1	8.9
1913	700	1	19.9
1914	180	1	8.3
1915	150	1	5.8
1916	175	1	8.2
1917	80	1	6.2
1918	160	1	6.2
1919	105	1	7.9
1920	145	1	2.7 for 10 months

Pumping station

The slow sand pumping station was too small. The machinery was crowded into about one-half the proper floor space. When the drifting sand plant was built provision was made for the removal of four pumps and motors, together with the switchboard for controlling same. The removal of these pumps, motors and switchboard improve the old station very much. There is still insufficient head room but this cannot be rectified without raising the outside walls and reconstructing the roof.

Raw water pumps

The raw water is pumped to the filter beds by three vertical screw, electrically-driven pumps, having capacities at present of approximately 16, 17 and 19 million gallons respectively at nine feet lift, and one steam auxiliary pump of about 65 million gallons capacity. The bearings of these vertical pumps, situated at the bottom of the draft tubes, have given some trouble and have had to be replaced. The arrangement of these pumps, while very compact, is not ideal when repairs are considered.

Boiler capacity

The boiler capacity of the old station was insufficient for operating the plant, including heating, when electric power failed. This was rectified when the new plant was built. Steam is now supplied from the new boilers.

Machine shop

As the filtration plant is situated on the Island and practically inaccessible to the mainland during the winter months, so far as bringing machinery or parts thereof to the City for repairs, a machine shop was absolutely necessary. As no shop was included in the slow sand plant, a temporary structure had to be erected and the necessary tools, lathe, drill, shaper, etc. installed.

Output or yield

The average daily output or yield of the slow sand plant has been, since 1912, as follows:—

1912........37.04 mill. gallons (12 months average,
1913........35.8 " " 11 months operation)
1914........31.996 " "
1915........32.4 " "
1916........32.9 " "
1917........30.94 " "
1918........29.25 " "
1919........26.70 " "
1920........32.00 " " estimated to end of October.

Between 1914 and 1917 the average was 32 million gallons per day. In 1918 and 1919 the average was about 28 million gallons, (explanation of this reduction is given elsewhere).

Average run of filters

It may be interesting to know that the average run of the filters, since 1913, is 21 days. In the winter it takes one day to rake and four days to scrape a filter, and in the summer it takes half the time to scrape, while raking is the same.

Quality of water

The quality of the water has been excellent.

The Drifting Sand Plant

In three and one-half years' continuous operation there has been sufficient time for difficulties to become apparent and remedies suggested and partially applied.

Sandwashers

The greatest difficulty experienced in the operation of the plant has been due to the wear of the throats in the sandwashers. This matter has had the close attention of Wm. Gore, M.E.I.C., designer of the plant and consulting engineer for the contractors. In the issue of

17th June 1920 of the Canadian Engineer is published a description of the sandwasher as now designed which has already been installed in three filters. The results indicate that the difficulty has been overcome. Some of these throats have now been in operation for eighteen months with little sign of wear. When all the old type of washers have been replaced, the difficulty in this respect will be practically eliminated and the cost of operation considerably lessened. Cost of renewals is charged to maintenance.

Extractor cocks

Owing to increased pollution of the raw water, the amount of alum has at times to be increased to 2½ grains per gallon. This combined with long periods of turbidity has a natural tendency to clog the filters. In order to offset this, the rate of sand drift must be increased. To facilitate operations, cocks have been placed on the extractors at a cost, chargeable to maintenance, of $7,000.00. Chlorination with filtration will give a sterile water and using the filters as a clarifying medium will mean the amount of alum can be greatly reduced. It is reckoned that one-half grain of alum per gallon, under these circumstances, will be sufficient.

Disturbance of gravel

Between the underdrains and the sand three layers of gravel of different sizes from .2″ to .75″ were placed with a depth of 9 inches. Until the attendants became experienced, the gravel was disturbed in some of the filters, while backwashing. This has been replaced by cemented gravel in two of the filters. This is an effective way of overcoming the disturbance, and as the rate of back-wash can be increased when desired, it is the intention to cement the gravel in the remaining eight units, at the rate of two per year for the next four years, cost to be charged to maintenance. Since the operators have gained experience, it is questionable if this expense is justifiable.

Overflow

The overflow channels for carrying off the backwash water are placed inside the filters. Perhaps if they were placed outside, the efficiency of the backwash might be increased. This is a debatable point and is merely mentioned for purposes of discussion.

Design and construction

The design and construction of the buildings and equipment are excellent and few additions or alterations have been found necessary.

(a) Owing to possibility of electric power failures, an auxiliary steam pump was installed so that the large number of hydraulically operated valves could be manipulated independent of electric power.

(b) In the chemical house the sulphate of alumina solution attacked the mortar of the tile brick work of the mixing chamber. To overcome this a lining of trap rock and portland cement was placed inside the chamber, which has given excellent service.

(c) The steel hydrometer tanks in the constant density chamber were coated with paraffin wax. The wax is wearing well, but it was considered advisable to cover the tanks with sheet lead, the cost of which has been charged to maintenance.

Crane

Owing to the war the contractors were unable to furnish the crane for unloading the coal and alum from the scows to the bunkers, and up to the present this has to be done by hand.

No funds for grading, &c.

Funds have not been forthcoming for the completion of the grading, roadways, sidewalks, etc. and the plant is suffering in consequence. Sand blows in through the buildings and increases operating costs. The surroundings are certainly not creditable, especially when it is seen that the City has over $2,000,000 invested in the completed plant.

No scour on plates

It has been mentioned by some, who are not conversant with the facts, that the scour on the inside of the filters would prove a very heavy item of expense, due to the drift of the sand wearing the iron plate. This, however, is not the case, the rate of drift being so low that scour is absent.

Effluent

It has been claimed, owing to the absence of pre-coagulation and sedimentation in the drifting sand plant, there is a trace of aluminum hydrate in the effluent, which, has been said, does not exist in the effluent from the other types of mechanical filters. Mr. Norman Howard, bacteriologist, and Frank Hannan, chemist, both at Toronto Filtration Plant, have spent a great deal of time on the subject and have been in correspondence with numerous engineers and sanitarians as to the conditions existing in the States of New York, Rhode Island, Maryland and Province of Ontario. The concensus of opinion was that the presence of aluminum hydrate in the effluent of many mechanical plants was not an unusual condition and was frequently met with. (See paper by Norman J. Howard and Frank Hannan, Canadian Engineer, 13th May 1920). From this, therefore, we may safely conclude that the effluent from other mechanical plants using sedimentation and coagulation basins is not any better in this regard than the Toronto plant. The quality of the water has been excellent.

Class of labour

Exclusive of the pumping station or engine room, the staff required for the operation of the drifting sand plant must be of a better grade than that required for the slow sand. No doubt this would apply to any mechanical filtration plant.

Effect of turbidity

If an absolutely clear effluent is demanded during a prolonged period of high turbidity, the rate of filtration is reduced by about one-third.

The drifting sand plant recovers its capacity more readily than the slow sand plant. It may take nearly two weeks for the slow sand plant to get back to normal conditions after a turbid period, whereas the drifting sand plant recovers in about a day.

Run of filters

The average run of filter in 1919 was about 1¼ days. This is not considered a fair estimate as the large quantities of alum used, due to heavy pollution, and the difficulties with the sandwashers made frequent back-washings necessary. Recent results show that the run will be from 3 to 7 days. A filter is out of commission about 35 minutes for back-washing.

Machine shop

The machine shop was improved and enlarged when the drifting sand plant was in operation.

Cost of Operation, etc.

We now come to the question of cost of administration, operation and maintenance. The actual costs are those taken from the official records. The equivalent costs are those based upon equal construction costs, together with equal rates for interest and sinking fund. Costs are also given for equal working conditions, which means both sections of the plant operating at its safe capacity.

In arriving at the correct cost of both sections of the completed plant, the following explanations are necessary:—

The reservoir, though built and included in the cost of the slow sand plant, is common to both, consequently half the value will be included in the cost of each section.

In the operation of the slow sand plant it was found, as already stated, that the boiler capacity was insufficient and the engine room too small for proper manipulation of the apparatus. In the design of the drifting section, these defects were remedied by installing sufficient boilers all under one roof to operate the completed plant. Also four pumps and motors, together with accompanying switchboard, were moved from the old to the new engine room. Further, as electric power failures were possible, the installation of a turbo-generator set, of sufficient capacity to operate all the electrically-driven pumps, including slow sand, was imperative. This necessitated making the engine and boiler rooms in the drifting sand plant considerably larger than was actually required for drifting sand purposes.

A concrete wharf was also included in the contract price of the drifting sand plant, and adjustments have been made in the cost to cover this, together with the other items. The following, therefore, shows the corrected or revised costs:—

	Slow sand	Drifting sand
Cost of drifting sand plant (exclusive of land)............		$1,165,378.56
Debenture discount......... .		71,246.60
		1,236,625.16
Deduct items, which were installed for better operation of slow sand plant, totalling....		91,183.66
		$1,145,441.50
Cost of slow sand plant (exclusive of land)..............	$792,183.69	
Deduct reservoir from slow sand	90,000.00	
Deduct wharf from drifting sand		23,185.00
	$702,183.69	$1,122,256.50
Value of land for reservoir one half each.................	7,937.50	7,937.50
Value of land occupied by each plant.....................	85,625.00	16,250.00
Reservoir one half each.......	45,000.00	45,000.00
Wharf one half each.......	11,592.50	11,592.50
Additional cost chargeable to slow sand, being proportion of engine and boiler rooms, turbo-generator set, boilers, etc......................	91,183.66	
	$943,522.35	$1,203,036.50
Deduct 10% of cost of drifting sand plant to compensate for excess cost as against time when slow sand plant was constructed...............	9,118.36	112,225.65
	$934,403.99	$1,090,810.85
Safe average daily capacity in mill. gall. (comment on this item later)................	32	50
Cost per million gallons on safe average daily capacity......	$29,200.00	$21,816.73
Annual interest payable in 30 year 3% debentures, sinking fund 5%.................	$66,342.61	$78,447.00

The total value of the filtration plant site is $233,357.00 which comprises 37.34 acres. The combined plants occupy 18.84 acres which is included in the above costs. The remaining 18.5 acres originally allowed for extension is unused. The value of the unused portion is not included.

Combined cost for 1918-1919	Slow sand	Drifting sand
Net yield of filters in million gallons...................	20,425.17	25,278.11
Actual cost of administration, operation and maintenance..	$148,940.17	$292,984.96
Interest and sinking fund (exclusive of land)...............	$85,821.47	$151,706.42
Interest and sinking fund on value of land (6%).........	$11,227.55	$2,902.50

Total interest and sinking fund	$97,049.02	$154,608.92
Cost of operation and maintenance per million gallons	$7.29	$11.59
Interest and sinking fund per million gallons	$4.75	$ 6.11
Total cost per million gallons	$12.04	$17.70

As the debentures for both sections of the plant do not bear the same rate of interest and sinking fund the above could not be considered a fair comparison. By substituting the calculated amount for interest and sinking fund on corrected basis and revised equivalent costs, we have:—

	Slow sand	Drifting sand
Cost of administration, operation and maintenance as before	$148,940.17	$292,984.96
Interest and sinking fund, 2 yrs.	132.685.22	156,984.00
Total	$281,625.39	$449,878.96
Cost of administration, operation and maintenance per million gallons	$ 7.29	$11.59
Interest and sinking fund per million gallons	$ 6.50	$ 6.20
Total cost per million gallons	$13.79	$17.79
Ratio of costs per million gallons	100	129

It is the practice to operate the slow sand plant to its maximum while the drifting sand merely makes up the difference required for the total consumption. The average daily output for 1918-1919 was 27.98 million gallons for the slow sand and 34.63 million gallons for the drifting sand plant. Thirty-two million gallons per day has been given as the safe average daily capacity for the slow sand plant. Owing to repairs to the raw water pumps, transferring of sandwasher pumps from old to new engine pumping station, and high water level in reservoir during the night, this capacity has not been obtained. During 1920 the yield will average in excess of 31 million gallons.

To increase the output of the slow sand plant from 27.98 to 32 million gallons under this condition would mean operating a large steam-driven centrifugal pump. This unit even at full load has a low duty and to run same at a small percentage of its rating, means, of course, very inefficient operation. On a 24-hour basis the coal alone would cost at least $45.00 per day, to which would be added oil, waste, etc. It was, therefore, considered more economical from the general operating standpoint, in 1918-1919, to call upon the drifting sand plant for the difference. In 1920, however, owing to heavy pollution and scarcity of alum, the steam auxiliary was used at times. To improve the operating conditions, during the night run, the installation of a 20 to 30 million gallon filtered water reservoir has been suggested, and, it is hoped, will be adopted. This would allow the whole of the filtration plant to be operated at practically a steady rated load, an ideal condition.

In order, however, that the slow sand plant should not be taken at a disadvantage, we will assume the plant actually filtered 32 million gallons daily without the use of the steam auxiliary raw water pump. The increase of 4 millions daily would cost, for electric power and sundries, under normal conditions, about $2,500 per year. Labour costs would remain as before.

The drifting sand plant has shown it can readily give 54 million gallons daily and placing the same at 50 million we are on the conservative side. The drifting sand plant in 1918-19 was operated at 69.2% of its capacity taken at 50 million. To increase this to 50 million gallon rate in order that it be placed on the same basis as the slow sand plant, the following would be added to the cost:—

Increase in electric power 1,800,000 K.W.H. @ .175c	$ 3,150.00
15.4 mill. gallons per day @ 1¼ grains alum per gallon @ $44.20 per ton	22,182.50
Sundry additional repairs, estimated	717.50
For one year	$26,050.00

The figures based on both sections of the plant working at capacities of 32 and 50 million gallons respectively, together with interest and sinking fund based on equal financial rates and equivalent construction costs, are therefore as follows:—

	Slow sand	Drifting sand
Total yield in mil. gals.—100% 32 and 50 mill. gallons respectively	23,360.00	36,500.00
Cost of administration, operation and maintenance, as before	$148,940.17	$292,984.96
Additional cost for 2 years as shown above	5,000.00	52,100.00
Interest and sinking fund	132,685.22	156,894.00
	$286,625.39	$501,978.96
Total cost per million gallons	$12.26	$13.75
Ratio of costs	100	112

Drifting sand costs 12% in excess of the slow sand.

There is still another feature, and an important one, which must not be lost sight of and which will have considerable bearing in the future on the operation of the drifting sand plant. By chlorination with filtration a large saving in alum may be effected. The alum used in 1918 and 1919 amounts to 2,252.83 tons costing $99,595.13. It is estimated that with pre-chlorination, approximately $25,000 per year can be saved or $50,000 in two years. If these estimates are confirmed the following would hold good:—

Cost of administration, operation and maintenance as above	$345,084.96
Deduct for alum	50,000.00
	$295,084.96
Cost per million gallons, administration, operation and maintenance	$ 8.08
Cost per million gallons, interest and sinking fund	4.29
Total cost per million gallons	$12.37

or about the same as slow sand plant under the very best operating conditions.

The drifting sand plant maintenance costs will be reduced about $7,500 per year when the changes to sandwashers, etc. have been completed. This amount has not been taken into account in the above final calculation.

Conclusions

(1) The cost of the slow sand plant, owing to favourable local conditions, was considered extremely cheap. The drifting sand plant did not share this advantage. It is questionable if the 10% reduction made by the author on the cost of labour and materials is sufficient to reduce same to the equivalent cost basis of the slow sand.

(2) The space occupied by the slow sand plant is eight times that of the drifting sand for given output.

(3) The effluent in both cases is excellent.

(4) There is no scour on the plates due to the drifting of the sand.

(5) The principle of the drifting sand has proved to be sound and the continuous sand-washer is a success.

(6) Ice forming on the slow sand beds retards sand-washing operations. Cold weather does not affect the drifting sand.

(7) Prolonged periods of turbidity affect both types, but the drifting sand plant recovers its capacity more quickly.

(8) Labour has to be of a higher grade in the operation of the drifting sand filters than that required for the slow sand filters.

(9) Pre-coagulation and sedimentation unnecessary with the drifting sand plant.

(10) By chlorination with filtration and both plants operating as last herein before mentioned, the cost, including administration, operation and maintenance, interest and sinking fund, will be practically the same in both plants.

Heating and Ventilation of Paper Machine Rooms

An analysis of the heating and ventilation problem for the paper machine room, the need for adequate ventilation to remove moisture, description of systems in use and proposed.

Edward A. Ryan, A.M.E.I.C.

Read before Montreal Branch, The Engineering Institute af Canada, November 18th, 1920

Progress made in recent years, in the pulp and paper industry, particularly with reference to the increase in speed of machines and concentration of apparatus, has opened up a new field of endeavour for the engineer, especially he that is interested in heating and ventilation. The problems to be solved have been rendered perhaps more difficult and require the services of a man who has made a special study of this line of work, because of the present day tendency of localizing in one centre the various processes consequent to the production of the finished article from the raw materials as they come from the rivers or forests.

The principle of ventilation, for drying, has been used from the time paper was first made i.e. when hand pressed sheets were suspended on racks and hung up in lofts to dry, the natural air currents through open windows etc. carrying away the moisture. Then came the adoption of heated rolls, over which the sheets (after pressing) were passed, in order to accelerate the process. At first these rolls were operated at comparatively slow speed and the moisture driven off was not in greater quantity than what could be successfully handled by the air currents produced by openings in roofs, walls, etc. The Fourdrinier was then developed — a machine on which the pulp was mechanically formed into a continuous sheet, over a wire, replacing the previously common methods of sheet production by hand. This latter machine was then connected up to the roll drying system and two operations, of widely different character, were performed in the same room i.e. the one in which the consistency of the pulp was reduced, practically speaking, to that of water (in the mixing box ahead of the Fourdrinier) and the other in which it was increased to that of the finished paper; all of the water added in the first machine being driven off in the second.

Gradually the speed of these two machines and the widths of sheets were increased, due to improvements in design, and while in 1867 a machine to make a sheet 100 inches wide at a speed of 100 feet a minute was phenomenal, a sheet 200 inches wide made at a speed of 500 feet a minute is common to-day and there are machines in operation now, as also a number under construction for a speed of 1000 feet a minute. Furthermore, it has been the practice in many cases with existing machines to increase their speed above that for which they were originally designed. It has thus come about that in a room of practically the same size, the quantity of water vapour produced is many times what it would have been in the early days, and exterior forces must necessarily be exerted to cause the passage of a sufficient amount of air to absorb the moisture produced.

The problem must not be considered solely from the point of view of the machine room proper, for, in the modern development comprising a group of buildings, the conditions and requirements differ very materially in the various sections. One usually has to contend with one or more machine rooms in which the heating requirements are small compared with those for ventilating, and these rooms may be connected through corridors, stair wells, elevator shafts etc., with the finishing rooms, shipping sheds, beater rooms, screen rooms etc., in some of which the moisture content must be maintained at a minimum and in others in which it is not so important. Owing to the intercommunication however, a careful study must be given to the design and operation of the various systems so that the conditions resulting will not produce contrary effects.

Need for Adequate and Proper Ventilation

It will be noted that heating is not mentioned, for the requirements to keep a paper machine room warm are negligible compared with the requirements to heat the amount of air necessary in winter time up to the desired temperature and increase its capacity for the absorption of the vapor produced in the drying process.

From a number of machine rooms, the writer finds that on an average for this neighbourhood, in minus 20 degree Fahrenheit weather, the British Thermal Units per cubic foot of volume to supply the radiation losses through walls, roofs etc., amount to about 1.5, whereas the British Thermal Units necessary to heat the required quantity of air to be delivered to the same room range from 10 to 20. In winter time, the heat radiated from the dryers alone is probably ample to supply the losses through walls etc. and, in summertime, there is no need of heating but rather a great need for ventilation, in the interests of the employees' comfort, in addition to the need of absorbing the vapour generated.

It is thus obvious that the problem is essentially a ventilating one and the system, to be adequate, must absorb and carry away from the machine room the vapour produced, both from the wet end and from the drying end. If it fail to do this, in whole or in part, condensation will occur on the surface of all objects that are at a temperature lower than that of the saturation point of the air in the room, such as walls, windows, steelwork of roof and machines.

The formation of condensation is objectionable for the following reasons:—

If it occur at points over the wet or dry end of the paper machine, it will drip on to the sheet of paper with a resulting poor product, frequent tearing and consequent loss of production.

In mills where the roofs are of wood, and they are by far the large majority among the older ones in this country, condensation promotes a rapid deterioration of same. Experiments that have been carried out show that decay, or the growth of fungus in other words, begins in wood at a relative humidity of 70 per cent, continuing at the higher volumes until a maximum is reached at which it does not go on further. It will be seen, from a typical example given later on, that even in a well ventilated mill the actual condition of the air is very near to the above critical point. A very complete treatise on this phase of the subject appeared in the Pulp and Paper Magazine in January 1920, under the title of "Prevention of decay in timber in pulp and paper mill roofs", the author being R. J. Blair of the Forest Products Laboratories of Canada. Mr. Blair, in this article, gives the results of an investigation made on 80 mills, in which it was found that the life of the roofs was from 5 to 19 years, with an average of from 8 to 10 years. "All this trouble", he states, "is preventable if special precautions are taken in building the roof and caring for it afterwards". He goes on to mention the precautions necessary in the design and building of the same, and recommends under the heading of "caring for it afterwards", that, "the moisture be removed from the building by ventilation."

It will be observed from the foregoing that the average life of wooden roofs is very short, and the upkeep cost, to say nothing of the loss of time in replacement, is very high.

On the other hand, the advantages accruing from a properly designed and operated system, are many, the more important of which may be summarized as follows:

Increased production, due to fewer shutdowns.
A safer place for the workmen.
A more even product.
A longer life of machine felts.

The first of the above advantages is obvious.

As regard the second, it might be well to point out that a paper machine is a piece of apparatus around which there are numerous gears, belts and other contrivances in which a man is liable to become caught and if, due to a vapour laden atmosphere such as is common in many machine rooms, these gears etc., become obscured the chances of accident are much greater than where such a condition does not apply.

In reference to the evenness of product, this is cited as a matter of personal opinion only. It may be mentioned, however, that it is a well recognized fact in allied industries, such as the textile, leather drying, film drying and others where drying takes place, that a generally uniform humidity and temperature must be maintained in order to obtain good results.

The writer can speak from experience concerning the life of machine felts. In two machine rooms of practically the same size and containing two machines of about the same capacity, in one of which the air condition, as regards moisture content, was better than the other, it was found that the average life of dryer felts (neglecting renewals due to accidents proper) was 18 per cent longer in the better ventilated room. This figure is based on records kept for a period of two years. Again, for the same period it was found that the top felts had a longer life than the lower ones on one machine. An investigation was made and upon determination of the air quantities to the pits, the one machine was being supplied with considerably less than the other. This condition was remedied and the good results were at once apparent. On account of the high cost of felts and the value of time lost in their replacement, loss of production etc., it is evident that this is a very important consideration.

Systems in Use

The systems most commonly in use to-day are:—

Gravity systems of supplying and exhausting.

Mechanical systems of exhaust only: the entrant air coming in through doors, windows and other openings, the fan discharging through openings in walls or roof.

Mechanical systems of supply only: the entrant air being passed over steam heated coils (in cold weather) and its temperature raised to the desired point. In summer time, no heating of the air takes place. After passage over the coils, the air is handled by a fan discharging into the machine room, through a series of ducts, the latter generally located in the roof trusses. Frequently, a portion of the total air is discharged under the machines, into the pits. Openings are left in the roof or walls, over or near the machines, for the air to pass out, after it has absorbed what vapour it can. In many plants a hood is placed directly over the dryers and at various points there are openings from these hoods to outdoors.

Systems in which steam pipes are located in the roof trusses and along walls, the air being supplied or exhausted as in the former ones.

Combination systems of mechanical supply and exhaust.

Of the first mentioned type there are still some in use but they are not satisfactory, unless in mills where the machines are of slow speed and the quantity of vapour produced is not very great.

The second type is more common than the former but there are many objections to it in a climate such as ours. It depends for its operation upon the air that will find its way to the fan through various openings to the room. In winter time, the entrant air must take what heat it can from heating coils located at the roof, along walls etc., and also from the heated dryers of the paper machines. This causes objectionable draughts, which are injurious to the health of the employees, who incidentally are not very heavily clothed, and the clothing they have on is invariably wet. Furthermore, owing to the air not being preheated, it cannot absorb as much vapour per unit of volume as it would were its temperature higher, when passing over the points at which there is a production of moisture. Then there is grave likelihood of dead air pockets, as the locations of openings for air to enter the room are not generally such as to promote the passage of air where it will be the most effective.

The third type mentioned is preferable to either of the former, provided the quantity of air be sufficient, that it be maintained at the proper temperature and that the location and spacing of the inlet ducts be such that the air will reach the proper points and that suitable provision be made for the discharge of the vapor laden air. This system is sometimes referred to as the "Sturtevant System", but since fans and heaters may be obtained from many other firms and in combination with a system of ducts used to perform the function of moisture absorption, it is hardly in order to consider it as being an arrangement on which that company, or any other in fact, has a monopoly. There are certain objections to the principle of supplying air only, for it causes the room to be placed under a pressure and some of the air, at a high temperature and relative humidity, will find its way to interconnected buildings, where it will cool down and a deposit of moisture will occur. Again, some of the air will become pocketed in skylights and at other points, which upon cooling, will cause condensation.

The combination system of supplying and exhausting mechanically is by far the best and the one in most common use in modern mills. It has none of the objections of the others and possesses many advantages, if properly designed and operated. It is more expensive to install but whether its operating cost is higher than the others is questionable, for it is difficult to measure coal and power cost with the value of increased production, savings in building repairs, smaller number of shutdowns, destroyed sheets etc. It is flexible in every respect and possesses the great advantage that the pressure in the room may be maintained at the desired point — a very essential thing where buildings are connected together. Provision can be very readily made with this system for the recirculation of a portion of the air in cold weather — a thing that has been found to give very satisfactory and economical results, as the absolute humidity of the air is usually low when the temperature is low.

Considerations for the Design of a Ventilating System

Since it is the object of the ventilating system, primarily, to carry off from the machine room the vapour created in the process of the formation of the sheet and its drying, it is obvious that the quantity of air handled must be in direct proportion to the output of the machine or machines in the room. I have good reason to believe that in a great many instances this is not done in the design and that the quantities are determined from a consideration of the volumes of the rooms. This is entirely wrong, as two rooms of the same size and design, might equally well house two machines of very different capacities, or again, two machines of the same capacity might very well be installed in rooms of different volumes, owing to difference of design and layout. It is interesting to note that comment is very often heard in mills of the seeming decadence of the ventilating system. Whereas in the beginning it seemed to give satisfaction, it does not appear to be maintaining as good conditions after several years of use. In some cases this is a consequence of poor operation, in others, as a result of changes made in the mill or to the system itself, and again there is the natural loss of efficiency due to age, such as growth of leakage through openings where there should not be any.

I believe that in most cases, the inadequacy of the system may be traced to an increase in production of vapour, resulting from an increase in machine speed such as has taken place in many mills recently.

It may not be amiss to recall, at this juncture, a few fundamental principles and explain certain terms that recur at various places throughout the discussion to follow.

Humidity is the moisture of water vapour mixed with the air in the atmosphere, and the weight of water vapour a given space will hold is dependant entirely upon the temperature.

Absolute humidity of the air is the weight of water vapour in a given volume at a given temperature and percentage of saturation and is usually expressed in grains per cubic foot.

Relative Humidity is the ratio of the weight of water vapour in a given space to the weight which the same space is capable of containing when fully saturated at the same temperature.

Saturation, or dew point — Air is said to be saturated, or in other words, the dew point has been reached, when it has mixed with it the maximum possible amount of vapour for the particular temperature.

For the same dry bulb temperature, the higher the relative humidity of the air, the lighter it is.

As an average figure for a newsprint mill, about two pounds of water per pound of air dry paper is driven off in the drying process. This figure is based on the assumption that the consistency at the wet end is .7 water and .3 pulp, and at the calenders .9 paper and .1 water. The former figure is of necessity subject to variation, depending on the relative proportions adopted in any particular mill.

In addition to the foregoing quantity, an allowance must be made for the moisture emanating from the process at the wet end which is absorbed by the incoming air. This quantity is difficult to specify exactly, but it is considerable, for, the condition at this point of the room might be compared to that in an ordinary humidifier or air washer — i.e. a multiplicity of water sprays and a fast moving sheet of wet paper, in process, over which air is passing. Recent tests that carried out by the writer, in a comparatively well ventilated mill, showed that there was an increase in relative humidity of ten per cent between a station located about four feet above the third press and another about six feet above the floor in the aisle, half way along the length of the dryers. It is thus apparent that in fixing upon the amount of air to be supplied to a machine room, an allowance must be made for the vapour taken up by air in passing over the wet end. It would be wrong to make this allowance as a percentage of the total air supplied, for, while the temperature of a machine room is roughly the same in winter and summer, the condition of the air outdoors is vastly different for these periods. An opinion borne out by tests is that it is preferable to supply the air, or at least the greater proportion of it, at the wet end of a machine room.

Air Distribution

The air distribution, arrangement, location and number of inlet and outlet openings play a very important rôle in the successful ventilation of a room. This is a well recognized fact by ventilating engineers and too much emphasis cannot be laid on the necessity of using sufficient openings — a thing that is not generally done in paper mills. The customary construction of machine rooms is a peaked or flat roof supported by trusses varying in height from 7 ft. upwards. With but few exceptions, round distributing supply mains are used and these are located in the trusses. Openings are left in every bay of about 20 feet. Attempts have been made to improve conditions by directing the openings towards the roof in certain instances and downwards in others, but without much success. This design has few commendable features, the chief one being its cheapness. Its objections are many. Round ducts, in the first place, are not adaptable as are rectangular ones for the ready installation of control dampers to regulate the flow of air to the various outlets, this is a necessity with any ventilating system. Again, with ducts located in the roof trusses thus, it is not practical to get the proper number of openings and direct the air to all the points at which it is most required. The considerable number of members in the trusses, which present ever ready condensing points for moist air, cannot be easily reached throughout by the air in passage. This condition is particularly important in our climate, even though the steel be covered with cement or other protective material, for there is a continuous conductor from cold walls and roof, and if the air be anywhere near the saturation point, directly it comes in contact with these cold surfaces it will be reduced to the dew point and condensation will ensue.

The most commendable construction is that in very common use in theatres, auditoriums etc., where an enclosed roof space is formed by furring down below the bottom of the trusses with lath and plaster or cement and leaving openings in the latter wherever required, these openings fitted with control dampers throughout. The roof space is thus converted into a plenum chamber into which the fan or fans discharge and no distributing mains are required. This method of building roofs would eliminate many of the objectionable features of the former construction referred to and in addition to the room presenting a much more sightly appearance, the general illumination would be very materially increased, particularly if the ceiling were finished a light colour.

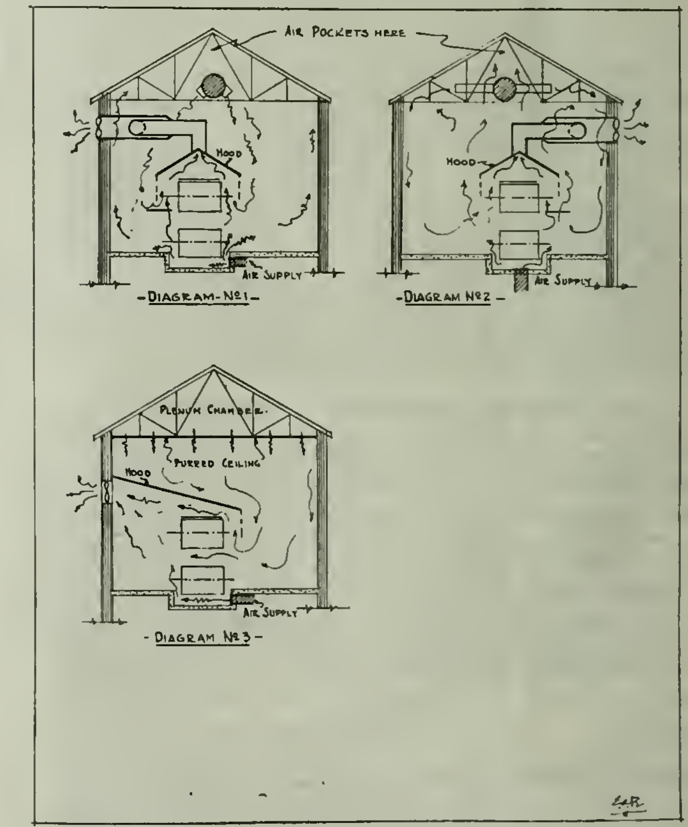


Figure No. 1

Typical Schemes for Machine Room Ventilation, Showing Probable Direction of Air Currents.

The arrangement of inlets and outlets around the dryers is of prime importance. In the design of the ventilating system, the endeavour throughout should be to control the air currents in such a way that they will converge towards this point of the room, thus preventing their escape elsewhere, once they have begun to absorb moisture. The use of hoods over the dryers is now quite common as is also the practice of blowing air into the machine pits and exhausting from the tops of the hoods. Some typical arrangements are shown on the accompanying drawings, which are diagrammatic only and do not show details, being given merely to illustrate the general principles of the schemes.

An endeavour has been made in figure 1 to indicate the probable direction and path of the air flow. With the first two schemes comparatively good results may be obtained, but they are subject to the criticisms hereinbefore mentioned as regards the use of ducts in the roof trusses. The third scheme is by far the best in the writer's estimation as the flow of air is positively one way and a better drying effect can be expected both as regards the room in general and also on the paper and felts. The value of this last consideration will at once appeal to anyone who has watched the action of the vapour at this part of a paper machine, for it has a tendency to rise from the felts of the lower rolls and pocket in the upper ones. If it be not promptly removed, a portion of the moisture has time to condense, and of course this must be re-evaporated in the upper dryers — an unnecessary repetition of process at the expense of energy. The writer has also noted from records kept that on machine rooms ventilated in the manner indicated under schemes one and two, the felts give way along the centre line and believes that this is due to the poorer circulation and drying effect at this point than at the outer edges where the circulation is better. The idea of supplying air into the machine pits is a very good one and should be adopted where possible.

The inlets to the pits and outlets from the hoods should be suitably disposed, the spacing not exceeding 15 feet. It is always preferable to use several openings of small dimensions than one or more larger ones.

Disc or propeller type fans are frequently used on the exhaust systems but care must be taken in the selection for capacity, particularly if they are connected to a duct system, as the characteristic of this type of fan is such that a very small resistance causes a material decrease in capacity.

As regards the condition of the air available for ventilating purposes, the following graphs should prove of interest. They have been compiled from the records of the Meteorological Service of Canada, the observations having been taken at McGill University Station, Montreal, and they can be applied for work in that neighborhood or for places where the climate is much the same.

The graphs shown are for the year 1917 and they show the relation between the maximum relative humidities and the mean temperatures on the days corresponding to that on which the maximum relative humidities occurred, together with the monthly means of the mean daily relative humidities and temperatures.

In order to simplify calculations and show more readily the actual condition or absolute humidity of the air, a development of the former graph has been made showing the actual weight of vapour per pound of dry air corresponding to the above, and the same are shown directly underneath. It will be noted also that these latter graphs are accompanied by a line of saturation corresponding to the temperature applying for the particular points.

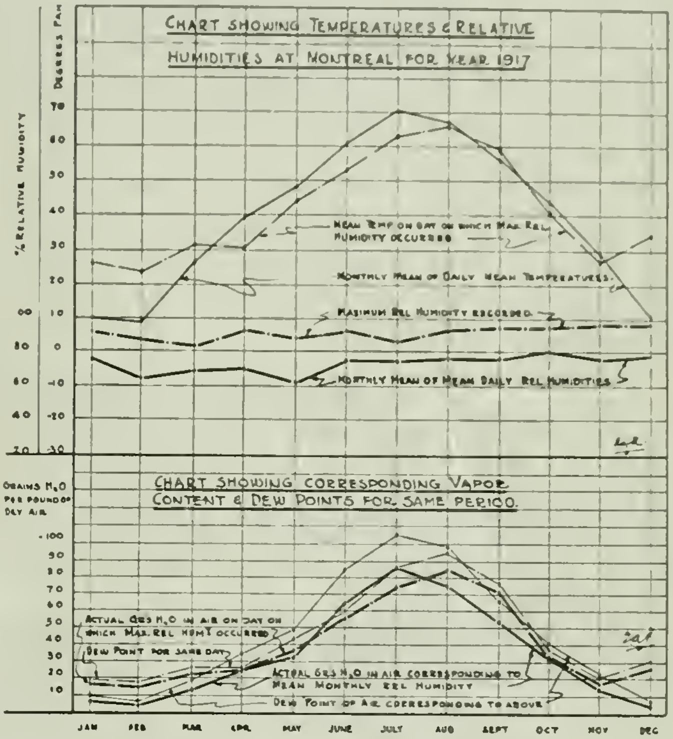


Figure No. 2

It is at once evident from this, the actual weight of moisture contained in the atmospheric air for the particular temperatures and that which it would contain if saturated. Obviously, the difference between these two is the weight of vapour that may be absorbed in the machine room, per pound of air delivered, provided it become fully saturated, its temperature be not raised and that it receive no vapour through leakage.

In practice, there will be a rise in temperature of the air, hence its capacity for absorption will be increased. There will also be an absorption of vapour due to leaks, depending on the arrangement and location of intakes, and also, if the principle of re-circulation be in use, there will be a reduction in the capacity for absorption. Furthermore, the air leaving the room will not be saturated.

From information gathered from operators in machine rooms, the periods of the year in which they experience the worst difficulties with condensation are, the spring and fall months — when heating is curtailed. If we examine the graphs the reason for this will be at once evident. It will be noted from the top graph that for the months of March, April, October and November, the monthly mean of mean daily relative humidities is generally higher, compared with the temperatures which are low, than in the other months. Since little heating is being done during this period, we have excellent cause for the production of moisture i.e. air having a minimum capacity per unit of volume for absorption and comparatively cold condensing surfaces in roofs and walls. Referring now to the second graph it will be noted that the actual moisture content of the air for these months, is practically the same for the maximum relative humidity recorded and the monthly mean of mean daily relative humidities. Note also how close these values are to the saturation point of the air. It must be borne in mind that in winter time, even though the air at the temperature of outdoors be near the dew point, this latter is raised when the air is heated and hence its capacity for absorption is raised. Note further that for the months of June and July the actual vapour content of the air was less per pound when the maximum relative humidity occurred than was the case for the monthly mean of mean daily relative humidities. This renders more evident the need of considering the air condition from its actual vapour content rather than to consider as extreme conditions those corresponding to days upon which the maximum relative humidity occurred.

In order to show the actual conditions that may be expected in a machine room, the writer has prepared a drawing giving the results of tests made recently in a well known mill. These may be considered as a fair average of the conditions existing in most of the best ventilated mills to-day and incidently, there is room for improvement, as in this particular mill there were a number of days throughout the year when conditions were anything but good.

This drawing shows the general arrangement of fans, heaters, duct system, machines, hoods and the stations at which observations were taken, together with the dry bulb temperatures, relative humidities and vapour content of the air at the stations for the wet and dry bulb temperatures applying.

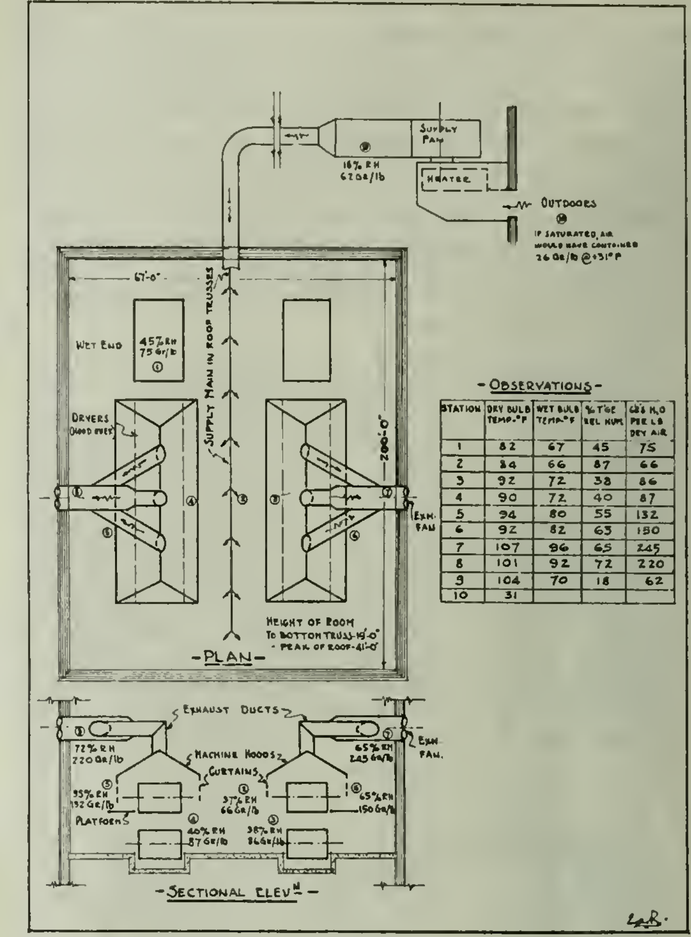
The points worthy of attention, as brought out by the above are:—

That the air leaving the fan contains more moisture per pound than that corresponding to the quantity at saturation of the outdoor air at the temperature applying. The reason for this condition in the particular instance was that there were numerous openings in and around the fan casings and heaters through which moist air entered, and the arrangement of the discharge from the mill was such that a great quantity of the exhaust air was drawn into the supply system.

That the air absorbed 25 grains of moisture per pound in its passage from the duct outlets to a point midway up the length of the dryers.

That the dry bulb temperature of the air was increased in its passage over the dryers (Stations 4 to 8 and 3 to 7) by 11 and 15 degrees respectively in the two machines. The wet bulb temperature, as also the moisture content were consequently increased.

In making a decision on the quantity of air to be supplied, it is obvious that due consideration must be given to all of the foregoing and to the average condition of the atmospheric air extending over a period of years. The supply of air constantly, to meet extreme conditions in any one year or month even, would hardly be justifiable. In the opinion of the writer, however, provision should be made in the fan drive so that the quantity may be varied by changing the fan speed to meet average conditions at any one period of the year. This can be readily done by using variable speed motors or by varying pulley sizes.



-OBSERVATIONS-

STATION	DRY BULB TEMP.-°F	WET BULB TEMP.-°F	% T'GE REL HUM	GR'S H₂O PER LB DRY AIR
1	82	67	45	75
2	84	66	87	66
3	92	72	38	86
4	90	72	40	87
5	94	80	55	132
6	92	82	63	150
7	107	96	65	245
8	101	92	72	220
9	104	70	18	62
10	31			

Figure No. 3

Conditions Determined by Tests in a Paper Machine Room, Daily Output 75 Tons.

Re-circulation

Re-circulation of a portion of the total air handled in extremely cold weather seems to give quite satisfactory results and an appreciable reduction in steam consumption can be effected by this means. The reason for the absence of trouble is that when the temperature is low, the actual humidity of the air is also low — (See graph No. 2), and hence a unit quantity of air is capable of absorbing more vapour than under other conditions. It should be oberved however that when re-circulation is taking place, the quantity of air removed by the exhaust fan should be decreased in proportion to the amount of re-circulated air, otherwise the room will be placed under a vacuum and an ingress of outdoor air will occur which is liable to produce bad results.

Automatic Control

As far as the writer is aware, there is no form of automatic apparatus on the market to-day that is practically adaptable for fulfilling the requirements as regards maintaining a desired degree of humidity in a machine room. The process in this class of building is the direct opposite of that for which automatic humidity control was developed — i.e. to keep the humidity up to a certain point, by the addition of vapour, as is done in textile mills, leather manufacturing plants, and in the ventilation systems of buildings. It is true that a very serviceable apparatus may be obtained to maintain a constant temperature, but what is required in a paper machine room is equipment that will control the temperature and air quantity so that an upper limit of humidity, that at which condensation occurs, will not be attained. If the air quantity be maintained constant and an attempt be made to control humidity by variation of the air temperature, there is grave likelihood of over or under heating, and, if it be attempted to maintain a constant room temperature, there will be no humidity control whatsoever.

There seems room therefore for the development of a practical piece of apparatus that will keep the humidity within the desired limits and also the temperature. Until this is done, the only solution is, intelligent hand control of operation.

Fans and Heaters

For the supply system there are two types of fan to be considered — the multivane and the steel plate. The former has the advantage over the latter in that it is more efficient — consuming from 10 to 20% less power for the same capacity and furthermore the space requirements for fan and motor are less.

For the exhaust fans, the disc or propeller types can be used where the duty is a nominal one only i.e. of directing the flow of air and, where there is no appreciable resistance. When the latter condition is not fulfilled it is better to use the multivane or steel plate type.

Speed control is highly desirable for the reasons mentioned hereinbefore and variable speed motors offer the easiest solution.

As regards heater, we have the choice between pipe coil heaters and cast iron "Vento". The latter are preferable in that better steam circulation and drainage are obtained, they are much more readily relieved of air and their cost to-day is not more than the former type.

Operation

The operation of the ventilating system requires but very little attention and satisfactory results will be obtained if intelligent care is taken. For the supply system, it is essential that the heaters be always free from air, that the condensation be promptly removed, that there be no leakages through which moisture may enter the fan suction chambers, and that the temperature and quantity of air be commensurate with the external conditions. Since automatic regulation is not available to perform the latter function to the required degree, it is advisable that temperature and humidity readings be taken at periodic intervals throughout the day, at various points in the room and of the outdoor air, and the fan speeds and air heating modified to suit. Records should be kept of conditions noted and the regulation performed, and, when these have extended over a period of a few years, a schedule of operation can be readily outlined to meet any conditions that are likely to arise.

Possibilities for Improvement and Development

As mentioned before, there is opportunity for improvement along the lines of humidity and temperature control, but the greatest field for development is in the way of improvement of overall economy by the utilization of the heat now thrown away in the discharged air and vapour from the machine room, the extent of this is hardly appreciated — it is enormous.

Let us consider the case of a machine room in which 150 tons of air dry paper are produced daily.

A rough figure for the quantity of air discharged per minute from the average mill of this size would be about 15,000 pounds. Its condition would probably be 75% relative humidity at 105 degrees Fahrenheit.

The heat content of this mixture is the sum of the heat in the air plus that contained in the moisture — the latter in the state of vapor. This, expressed in terms of the British Thermal Units above zero degrees Fahrenheit is:

Per pound of dry air..........................	25.37
Latent heat of vapour in 1 pound of air @ 75% relative humidity........................	39.00
B.T.U's per pound of air @ 105 Fahr. and 75% R.H..	64.37

Now suppose that this air be cooled to a temperature of 70 degrees Fahr. and that the contained heat be transferred to the incoming air or to water used in process work. At the latter temperature it would be saturated, the heat content being 33.51 B.T.U's per pound. The available heat becomes thus 30.86 B.T.U's per pound.

On our assumption of 15,000 pounds of air per minute, for a 150 ton room, there becomes available therefore $15{,}000 \times 30.86 = 464{,}000$ B.T.U's per minute, or sufficient heat to raise the temperature of 15,466 pounds of water per minute from an initial temperature of 40 degrees to a final temperature of 70 degrees.

Practice of Ventilation of Paper Machine Rooms

Discussion on "Ventilation of Paper Machine Rooms", by E. A. Ryan, A.M.E.I.C.

E. A. Briner, Mem. A.S.M.E.

From Mr. Ryan's paper it is evident that he is not one of those who regard moist atmospheric conditions in machine rooms of paper mills as indigenous to the business; but realizes that they are conditions which need not be tolerated but may be overcome by the application of scientific engineering principles.

The brief remarks following are based on sixteen years of experience in ventilation work, of which the last seven years have been devoted almost exclusively to paper mills, covering experience with about seventy paper machines and their machine rooms.

In order to get to his subject quickly, the writer will agree with the engineering principle stated by Mr. Ryan that some form of fan system for air supply and fan system of exhaust afford the most practical system for obtaining results.

An exhaust hood over the paper machine is a most desirable adjunct of the exhaust system, although, as will be shown later, it may not be an actual necessity under certain conditions of the air supply, where air is applied directly to the sheet instead of merely blowing the air against under side of roof.

The point about the hood is simple enough. A hood over a paper machine is sure to get rid of at least 80% vapour troubles at once without contact with cold undersurface of roof in winter. In summer the hood keeps down the machine room temperature by quickly removing both heat and moisture.

The air supply and exhaust fans must be figured amply sufficient to carry off all the moisture evaporated from the sheet of paper at the temperature that air usually leaves the hood, — around 105 to 110 degrees F. on large machines. Of course it is customary to allow a margin of safety of between 25 and 50% to insure success and permit an increase in production. Mr. Ryan's statement of quantity of water evaporated as being about double the weight of the finished paper is correct for covering quite a broad field of practice in paper such as news, writing paper, book, wrapping, pulp, roofing felt, some grades of boxboard etc.

Mr. Ryan has touched upon the value of recirculating the air whenever possible; a few practical examples illustrating this will be shown; after all the economy of the system is the final test which all systems have to meet.

Not only can the air be re-circulated to a much greater extent than is current practice, but by taking advantage of unavoidable leakage and the principle of continuous ventilation by using air received from other departments, the economy of the ventilating system in machine rooms can be brought to a satisfactory commercial basis without usual heavy expense for fuel.

Economy of Fuel

In Canada with abundant water power there is usually very little exhaust steam available from engines around paper machines. If all the exhaust from engines is used in dryers of paper machine, the ventilation ordinarily would become a live steam proposition, which is very expensive in view of the fact that the machine room requires such enormous quantities of air.

A practical illustration of the steam required (in round numbers), shows this weak spot in paper mill ventilation practice. In a machine room in which eighty tons of finished paper or dry pulp is turned out every twenty-four hours the moisture leaving that machine room per twenty-four hours would be 160 tons, or over 6½ tons of water per hour must be carried out of the roof ventilators on the "wings of the air".

Suppose we have to supply this air without going to extremes in zero weather. It would require in round numbers 60,000 cubic feet of air per minute raised to 90 degrees F. or 200 boiler horse power, if live steam were used, all air being taken from out of doors. By proper re-circulation of the air and raising its temperature this can be reduced to about 100 boiler horse power. The re-circulated air is not quite as good as fresh, dry outdoor air, but there is economy in its use.

Proper re-circulation of the air sounds well, but it is not understood by the average machine tender or mill superintendent. It must be incorporated in the design.

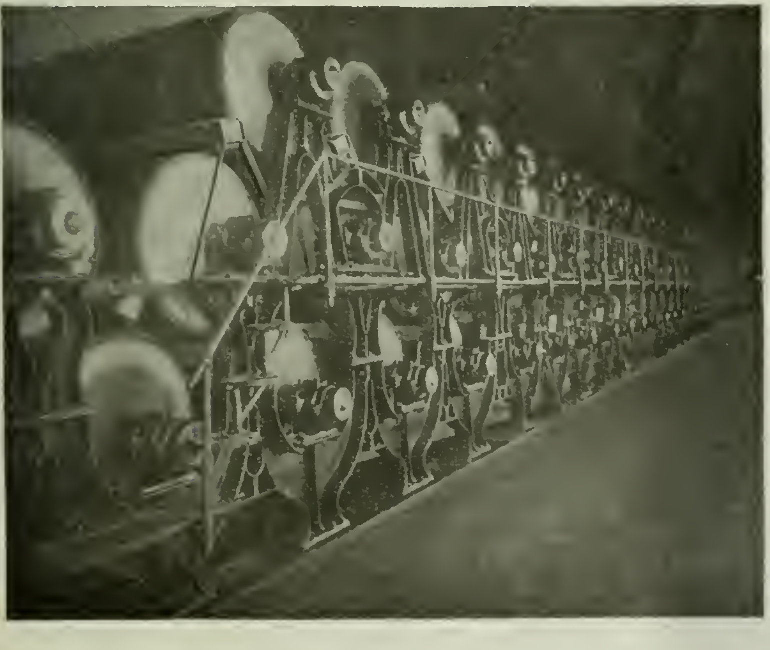
There is usually a tremendous amount of leakage of cold air into the shipping room. It is, therefore, good practice to try to begin there and arrange to recirculate all of this air in heating and ventilating the shipping room. The writer never makes provision in the shipping room for taking a separate air supply from out of doors and always lets the air come in as it is bound to come in around shipping doors, but warm air ducts are arranged to blow warm air on the floor just at the side or from over the tops of these doors. When shipping doors are opened occasionally the incoming air is tempered with this hot air. By providing no separate fresh air supply to the shipping room, it breathes naturally, is warmed artificially around the shipping doors and the system cannot be misused by careless handling of fresh air inlets in cold weather. Scarcely any moisture is picked up in the shipping room and invariably there is a current of air continuously going from shipping room to the machine room, to which it is drawn by the exhaust fans.

If no provision is made for recirculating the air by roof drying fans of the machine room, this air coming in from the shipping room would assist in carrying off vapour from drying machine. But by re-circulating it in the machine room and blowing it up against the roof first, it serves the purpose of keeping the roof dry at less expense than when the air is taken directly from out of doors, and then serves its final purpose in assisting the drying operation.

What has been said of the shipping room in the way of air supply, applies with almost equal force to beater room or screen room, usually at the other end of machine room. There is always plenty of air leakage in such rooms augmented by open doors through which perhaps stock is brought in. This leakage all finds its way into the machine room on account of suction of roof ventilators or machine hoods.

The deliberate use of this natural leakage coming from other departments, which the writer has carefully measured in a number of instances, is here called "continuous ventilation". The term is an old one; but its application has not been understood in the paper mill field. It is a big factor for economy and satisfaction and it would not be advisable to use any other method in the Canadian climate without doing the owners an injustice as regards operating expense. The methods of "continuous ventilation" described have worked out very well in a number of instances in machine rooms; and at same time have reduced the relative humidity in such rooms from about 80% to about 55%.

This 120-inch Machine actually did 69 tons with vapour absorption system, which was extended when more dryers were added. Ultimately an average of 80 tons of wall board were turned out per 24 hours. The system dries wall board sheet uniformly so they don't warp after being glued together.



This machine has 97 dryers, 42-inch diameter by 138-inch face, and has made 106 tons of boxboard per 24 hours. It averages 100 tons per day. They installed a small system of vapour absorption to make the room livable and increase their drying capacity. It accomplished both guarantees economically. This triple decker and another machine in Middle West have the U. S. records for tonnage on a single machine, and both are equipped with vapour absorption system.

Waste Heat

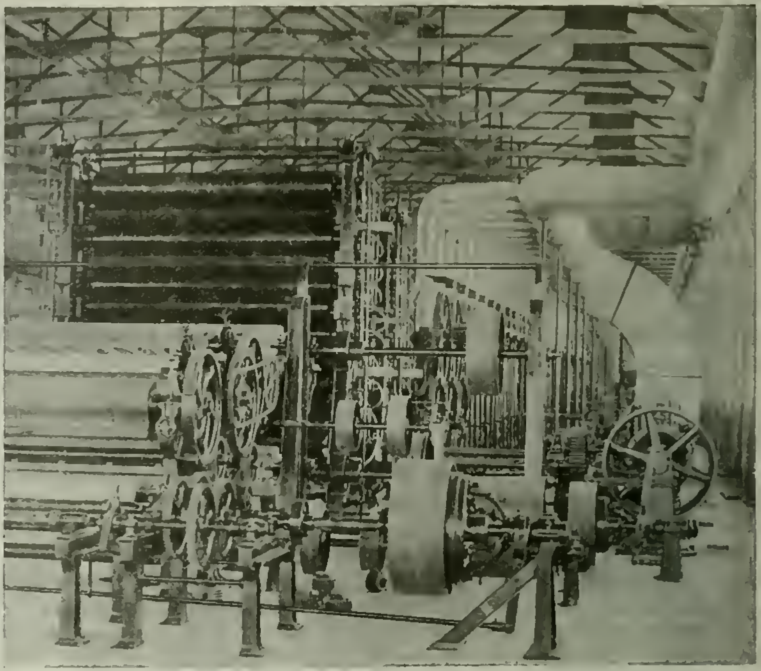
Lest some might think that considerable progress has been made in paper mill economy and would be inclined to feel satisfied with results achieved the writer will turn a little more light on the subject and point out another weak spot; Mr. Ryan has mentioned it in his paper. It is the heat escaping from hood or exhaust fans over dryers of the paper machine.

Mr. Ryan's figures are given as 464,000 B.T.U's per minute for a machine room making 150 tons of finished paper per twenty-four hours. If these figures are reduced to boiler horse power, for his 150 ton mill 843 boiler horse power is continually going to waste or about 5-2/3 boiler horse power per ton of product. To be very conservative 5 boiler horse power per ton of finished product goes to waste "up the flue". In the 60 ton mill example, not less than 400 boiler horse power goes waste.

A couple of years ago the writer installed a system for a large boxboard manufacturer in the West, making over 100 tons per twenty-four hours on one machine. His mill was a model for fuel economy. It held the record for tonnage on a single machine. It also held the record for coal economy per ton of paper in the United States. The writer was able to show him with figures that not less than 500 boiler horse power was going to waste out of the roof of his paper mill. When he finally acknowledged it, he remarked: "Yes I see the horse is there all right, but can you harness him up?" That sort of loss has taken place in a thousand and more paper mills in the States and Canada and in spite of all the talk about cost keeping and scientific accounting the writer believes that not a single set of books is in existence that shows this continuous loss.

You may be interested to know that Canadian winters helped to solve this problem. The thought came to look at the machine room problem very much as a breathing problem. Cold dry air is inhaled and warm moist air is expelled. What would happen to a man in Canadian weather twenty degrees below zero if he breathed through his mouth and exhaled through the middle of his back? Someone has said that his mouth would freeze up. This teaches the importance of taking air in and exhausting if possible from the same opening.

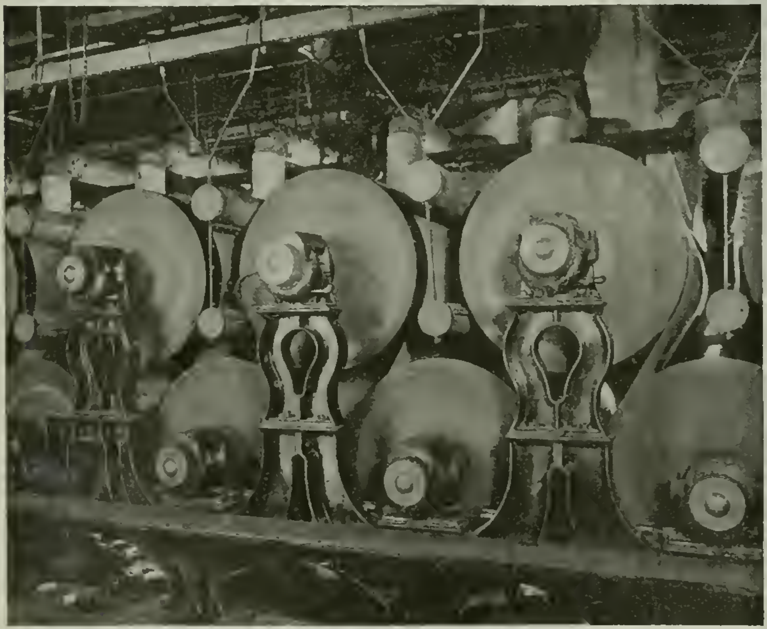
The new Briner Economizer will probably recover more heat than is necessary for ventilation of paper machine rooms and it is possible that their efficiency will run so high that some heat will often be available for heating shipping rooms and other rooms adjacent to machine room producing wonderfully dry and delightful atmospheric conditions and using practically nothing but waste heat and the necessary electric power to drive the fan apparatus.



At rear of machines, the main pipe is run so as not to interfere with future possibility of triple decking the machine. All pipes on machine are supplied with two or three portable slip joints. The illustration shows how pipes can be supported from floor to permit use of overhead traveling crane.

Briner System of Vapor Absorption on Paper Machines

Briefly the originators of this system were Belcher and Wilson. The connection which the writer has had with the same has been only in reference to recent development and the engineering work of most of these systems in use. The principal object of this system is to supply a series of blasts of hot dry air to the sheet on the drying machine instead of against the cold roof. The effect of this is equivalent to laying the axe at the root of the tree, increasing the drying capacity, and at the same time entirely removing by absorption all visible vapour and eliminating the roof drip. On machines, without dryer felts, it increases the drying capacity approximately 15% if the work is very thoroughly and accurately done. On machines making boxboard it makes a decided improvement in the quality of the product. The product has a smoother more velvety feel which calenders better because sheet has been dried on both sides simultaneously and the moisture has not been forcibly driven through the sheet, which has a tendency to disturb the "lay" and bond of fibre in the outer layers.



The ducts of this and another board machines are equipped with Deflector Nozzles running across entire width of the sheet in a continuous strip.

Pipes are arranged so as not to interfere with threading sheet through the dryers. When machines have dryer felts, they require a different arrangement.

The effect on room conditions is to reduce the relative humidity often from 80% to 50%. If properly installed it keeps down the room temperature a few degrees. The dryer atmosphere, however, has a much more important effect on comfort than a few degrees lower room temperature.

Roof Construction

Those who do not have to contend with moisture in buildings seldom realize the amount of work and operating expense which they incur by thoughtless roof construction.

A 4″ concrete slab makes a first class fireproof and waterproof roof; but it has such poor insulating properties that it is exceedingly difficult to keep dry. It can be done if the first cost of the system and operating expense are ignored. It is much more economical to provide a 4″ air space on top and 2″ of wood as an insulation with regular roofing material on top. Such roofs were put on all buildings of the Riordon Company at Temiskaming Plant, and in conjunction with ventilating systems installed there they have been a complete success in weather 15 and 20 degrees below zero.

Another construction coming into use is 4″reinforced gypsum slab with the regular roofing material on top. The gypsum has only half the weight of concrete and requires no further insulation. It is fireproof and if the ventilating system is first class it is fully equal to the concrete roof even thoughif it is not waterproof.

If the owner cannot afford fireproof construction then the roof should be at least 3″ thick of wood and preferably 4″ thick for Canada, — principally on account of insulation.

If the roof has not the proper insulation, it must be offset by increased cost of ventilating system to keep the roof dry and a continual extra expense for operation.

Concrete Ducts

The use of concrete in the building of air ducts at Riordon Company's plant at Temiskaming is a forward step of some importance. Not only the underground ducts in machine room but also the overhead ducts in machine room and other buildings were built of concrete. All the air ducts in this extensive plant are built of concrete. There are no galvanized iron ducts in the plant. The owners had experience in paper mills with the life of galvanized iron and they wanted a construction that would last forty or fifty years without expense for painting or renewals. This is not the first time that such ducts were built. The owners had built some before which were 4″ thick. The new ducts evolved with their co-operation were a big improvement. They are reinforced concrete and thickness runs from 1″ in small sizes to 1½″ in large sizes. The ducts are finished up smooth on the inside. They are reinforced with rods ¼ to ½″ in diameter and covered with Galvanized Clinton Wire Cloth, which forms the lath for applying cement plaster by hand. The cement plaster consists of one part Portland cement and three parts sand. The only objection to them is their weight.

Allowance is made in the way ducts are hung for expansion and contraction of 1″ per 100 feet of length. A year's use of these ducts in one of the severest winters of recent years when temperature at Temiskaming hovered between 15 and 20 degrees below zero during the whole month of January, they developed no defects in construction and every indication is that the owners have achieved their purpose of permanent construction and low maintenance. The writer has been told that in that severe weather there was no drip in this entire mill, which must mean a great saving in upkeep, renewals and efficiency.

An advantage of the concrete construction in duct work is that it can be done by regular building mechanics such as plasterers. They are built right in place with ordinary materials. It is easy to connect the last part of duct work with the fan after it arrives. On account of the newness of this work, its first cost is naturally greater than sheet metal work; but the writer believes that further experience with this work will bring the first cost down.

Undoubtedly, in a concrete building with its character of permanence, the concrete air duct has found its rightful place. In all the overhead work, the ducts being same color as concrete slabs, beams and columns, they fit into their surroundings beautifully and present a harmonious appearance that melts into the general structure.

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VOL. IV. January 1921 No. 1

New Year Greetings

The President and Council of The Institute take this opportunity of wishing each and every member of The Institute from the youngest student to the oldest charter member A Happy and Prosperous New Year. We are deeply grateful to all of you for your co-operation. We feel that, during the past year, particularly, a more agressive fraternal professional spirit has been developed, due in no small measure to the splendid work of the officers, executives and active members of the Branches of The Institute.

We urge you to maintain your interest; be loyal to your profession; boost it and those in it upon every opportunity, for by so doing you are promoting your own interests. While all that the past year may have promised has not been accomplished, let us look forward to the coming year with a firm faith in ourselves and a confident belief that by united action we shall go far towards realizing our professional ambitions.

Date of Annual General Meeting

The Annual and General Professional Meeting will be held in Toronto on February 1st, 2nd and 3rd, 1921. The Annual General Meeting is announced for January 25th at Montreal, as provided in the by-laws, and will be adjourned to Toronto.

Notes on Annual Meeting

The annual meetings of *The Engineering Institute of Canada* have become events greatly looked forward to by engineers. The meeting to be held in Toronto on the 1st, 2nd and 3rd of February will undoubtedly be very much worth while. Arrangements are well in hand according to the last report of the Toronto Committee, who for several months have been planning for this big event.

Members of *The Institute* are assured of excellent technical papers, and every provision for the entertainment of visitors is being made. It is anticipated that a number of members will be accompanied by their wives, and that there will be quite a number of lady out-of-town visitors.

A Ladies' Committee under the convenorship of Mrs. C. H. Mitchell has been formed and is now making arrangements for a reception which is to be held the first day of the Annual Meeting. The ladies, of course, will be welcomed at the dance which will be held the last evening in conjunction with the Engineering Society of the University of Toronto. Besides these events the ladies' committee is arranging for shopping parties, sightseeing parties, and will provide reservations at the theatres, and it is also possible that a musicale for the ladies may be arranged the same night as the smoker.

In providing suitable accomodation for the Professional Meetings at the King Edward Hotel it has been found necessary to transfer the excursions from Thursday morning, February 3rd. to Wednesday afternoon, February 2nd., the Professional Meeting for general papers being transferred to Thursday morning.

A partial list of papers to be read at the Professional Meetings follows:—

Chemical Section:

Uses of Hydrated Lime in Construction Work and Outline of Present Methods of Manufacture., Lucius E. Allen, M.E.I.C.

Pulp and Paper Section:

Motion Picture of the Pulp and Paper Industry. Motion Picture of the Kippawa Mill, courtesy Mr. Thorne, vice-president and technical director, Riordon Pulp and Paper Company, Limited.

Mechanical Section:

Control of Corrosion in Steel Mains, F. N. Stellar, metallurgical engineer, National Tube Company, Pittsburg.

Electrical Section:

Queenston-Chippawa Development of the Hydro-Electric Power Commission of Ontario, an illustrated talk by A. C. D. Blanchard, M.E.I.C.

Civil Section:

Cost Plus Contracts, J. Clark Keith, A.M.E.I.C.

Toronto Filtration Plant, James Milne, M.E.I.C.

Design of a Sewage Disposal Scheme for a City Located on Tidal Waters, C. J. Yorath, A.M.E.I.C.

Special Nomination

Since the publication of the list of nominees for officers of *The Institute* a special nomination for Vice-President has been received, accompanied by the acceptance of the nominee H. G. Acres, M.E.I.C. The nomination reads: —

"In accordance with Section No. 68 of the By-laws of *The Institute*, we, the undersigned, Corporate Members, hereby nominate Henry G. Acres, M.E.I.C., for the office of Vice-President:—

Alex J. Grant, M.E.I.C.,
Frank E. Sterns, A.M.E.I.C.,
W. H. Sullivan, M.E.I.C.,
Robert H. Harcourt, A.M.E.I.C.,
G. F. Vollmer, M.E.I.C.,
F. C. Jewett, A.M.E.I.C.,
F. S. Lazier, M.E.I.C.,
C. W. West, A.M.E.I.C.,
C. E. Macdonald, A.M.E.I.C.,
Wm. A. Bucke, A.M.E.I.C.,
J. R. Ambrose, M.E.I.C.,
J. G. Carswell, A.M.E.I.C.,
M. R. Meldrum, M.E.I.C.,
W. S. Lea, M.E.I.C.,
J. H. McLaren, A.M.E.I.C.
R. S. Lea, M.E.I.C.,
Norman R. Gibson, A.M.E.I.C.,
A. C. D. Blanchard, M.E.I.C.,
H. L. Bucke, M.E.I.C.,
H. B. R. Craig, M.E.I.C.,
Alfred J. Stevens, M.E.I.C.,
J. J. Newman, M.E.I.C.,
H. Thorne, M.E.I.C.,
J. E. Porter, A.M.E.I.C.,
K. E. Smith, M.E.I.C.,
C. H. Wright, M.E.I.C.,
C. O. Foss, M.E.I.C.,
F. H. Peters, M.E.I.C.,

The nomination was accepted by Council and the Secretary was instructed to include it in the ballot in accordance with the By-laws.

Proposed Amendments to By-Laws

Proposals to introduce new By-Laws, or to amend or repeal existing By-Laws in accordance with Section 75, shall be mailed to Corporate Members not less than twenty-one days before the Annual General Meeting.

Notices shall be deemed to have been mailed to Members as prescribed by the By-Laws, if such notices are printed in The Journal of The Institute and mailed by the dates prescribed in the By-Laws.

In accordance with these provisions of the By-Laws, the report of the By-Laws Committee in which it is proposed to introduce amendments is given herewith for the benefit of the Members. The report of the By-Laws Committee which follows was approved by Council, and is submitted to the members for consideration. "These proposals shall be submitted for discussion at the Annual Meeting and shall then be submitted by letter ballot to the Corporate Membership of *The Institute*."

"The Committee recommend the following changes in the By-laws of *The Institute*:—

Section 3 — Amend the last sentence to read: — "A Non-Corporate member shall not be entitled to vote on Institute affairs, or to hold office as an officer of *The Institute*, or as Chairman or Vice-Chairman of a Branch. He may be entitled to vote on Branch affairs or hold office in a Branch, other than as specified above, when so permitted by the By-laws of the Branch."

Section 9 — Amend second and third last words of paragraph one to read "thirty-three". The last sentence of paragraph one to read: — "He shall not remain in the class of Junior after he has attained the age of thirty-three years."

Section 10 — Amend second and third last words to read "twenty-seven". The last sentence to read: — "he shall not remain in the class of Student after he has attained the age of twenty-seven years."

Section 12 — Amend by the addition of the word "three" after thirty. The clause to read:—"The officers of *The Institute* shall be a President, four Vice-Presidents, and thirty-three Councillors."

Section 13 — Amend by substituting "eleven" for "ten", third line. Paragraph to read: — "The term of office of the President shall be one year; of the Vice-Presidents two years; and of the Councillors three years. Two Vice-Presidents and eleven Councillors, in addition to any required to fill vacancies, shall be elected annually."

Section 32 — Expulsion and Discipline. Amend last paragraph to read as follows: — "In case the Council on receiving a complaint in writing, shall be of the opinion that the conduct of any Corporate or Non-Corporate Member shall become the subject of enquiry, with the view to ascertain whether there are grounds for disciplining or expelling him; or, in case twenty or more Corporate Members shall think fit to draw up and sign a request for such an enquiry regarding any Corporate or Non-Corporate Member on any ground whatever, and shall deliver the same to the Secretary to be laid before Council for consideration; the Council shall first notify, by registered mail, the member against whom the complaint is laid, setting forth the charges and by whom made, and naming a date not less than six weeks from the date of such notification for the holding of an enquiry.

If the defendant member decides that he desires to be present in person at the enquiry, and so advises Council in writing, or by telegram, sent to the Secretary within four weeks from the date of mailing the notification from Council, the Council shall rename a day for the enquiry, not less than eight weeks from date of preliminary notification, and shall notify complainants and defendants by registered mail at least four weeks previous to new date set and shall request their presence at the enquiry. Should any complainant member, after receiving due notice, fail to appear at the enquiry without having previously given reason in writing or by telegram satisfactory to Council, the Council shall demand of such delinquent member in writing by registered mail, that he furnish the defendant member through Council, a written apology satisfactory to Council, or, send in his resignation from *The Institute*; failing doing so, the Council shall cause the name of such delinquent member to be erased from the register and thus expel him.

On the final date set for an enquiry, the Council shall make such enquiry as they deem adequate, the complainant and defendant members, if present, being given full opportunity for deposition and examination. Should Council not find sufficient reasons for disciplining or expelling the said member, no record of the enquiry shall be made in the minutes; but, if Council, by a majority of at least four-fifths of those present at a meeting especially summoned for the purpose, and at which at least twelve members of the Council are present, does find good reason for expelling or otherwise disciplining the said member on the ground that he has been guilty of improper conduct, the Council shall cause the name of such person to be erased from the register and thus expel him from *The Institute;* or otherwise discipline him at their discretion. The Secretary shall forthwith notify the member of the decision of the Council and, should the member be expelled, the Council shall report such expulsion at the next Annual General Meeting.

Should the complainant or defendant be a member of Council he shall not act as a Councillor in any matter affecting the enquiry.

No verbal or anonymous complaint against any Corporate or Non-corporate member shall be considered or acted upon by Council."

Section 34 — Annual Fees. — Amend section 34 to read as follows: — "The annual fees payable by Residents shall be as follows: —

Members	$18.00
Associate Members	15.00
Juniors	10.00
Students	2.00
Associates	18.00

The annual fees payable by Branch Residents shall be as follows:—

Members	$15.00
Associate Members	13.00
Juniors	8.00
Students	2.00
Associates	18.00

The annual fees payable by Non-Residents shall be as follows:—

Members	$13.00
Associate Members	11.00
Juniors	6.00
Students	2.00
Associates	18.00

Honorary Members shall be exempt from annual fees."

Engineers on Railway Commission

An editorial on the Railway Commission vacancy, which appeared in the Ottawa *Citizen* of December 6th, illustrates the trend of public opinion in connection with appointments to positions on Commissions where engineering knowledge and experience is needed. Hitherto all such appointments were for the most part considered to be a reward for political activity, and in most cases have gone to members of the legal profession.

At the time the editorial in question, which is given herewith, appeared, the matter had already been taken up officially with the Government, and is at the time of writing under consideration. The editorial follows:—

> The government might profitably give consideration to a suggestion made at **The Engineering Institute** meeting in Ottawa last Thursday. There is a vacancy on the Dominion board of railway commissioners. The president of the Ottawa Branch of **The Engineering Institute**, G. B. Dodge, M.E.I.C., expressed the opinion that this vacancy should be filled by an engineer. The commission has to deal with technical matters, as well as rates and legal points. One of the commissioners, at least, should be an engineer. Canada has developed a considerable number of outstanding men in railway engineering. The government would have no difficulty in finding one well qualified to serve as a member of the board of railway commissioners.
>
> The legal profession is ably represented on the present board. Political interests, too, have not been overlooked, in making the majority of the appointments. Political patronage is, however, supposed to be a thing of the past in Canada. Certainly, where railway questions are concerned, public opinion is alert to the necessity of eliminating politics.
>
> Premier Drury's courageous stand, in appointing a board of enquiry, before endorsing the proposed hydro radial scheme for Ontario, is winning public approval — notwithstanding the criticism to which the provincial government's policy has been subject in Toronto, from both sides of old party politics, as represented by papers like the Globe and the Telegram. The appointment of an engineering commissioner to the Dominion Railway Board, by the federal government, would appeal to the public as a sound new step Fuller recognition of the part played by the Canadian engineer in national affairs is due from the government.

EMPLOYMENT BUREAU

To make this department more valuable it is proposed that in future advertisements of situations vacant should state salary, and give details of requirements.

Situations Vacant

The Civil Service Commission of Canada hereby give public notice that applications will be received from persons qualified to fill the following positions in the Civil Service of Canada:—

Senior Investigator.

Senior Investigator for the Organization Branch, Civil Service Commission, at an initial salary of $2,700 per annum, which will be increased upon recommendation for efficient service at the rate of $180 per annum, until a maximum of $3,240 has been reached. This initial salary will be supplemented by whatever bonus may be provided by law.

Duties.—Under the direction of the Chief, Organization Branch, o make the more difficult and important investigations and surveys and to prepare reports thereon in connection with the organization of departments or in connection with the efficiency of persons or operations of individuals or groups of individuals within the several departments of the Governemnt; on occasion to make investigations in connection with and assist in the administration and maintenance of the classification of the civil service; in some cases to have supervision of the work of a portion of the staff; and to perform other related work as required.

Qualifications.—Education equivalent to graduation from a university of recognized standing, with at least four years of business experience, one year of which shall preferably have been in industrial investigation work, or several years of training in industrial management work with at least six years of business experience; knowledge of the routine and technique of making business investigations; supervisory ability; initiative; tact and good judgment; good address. Candidates must be 25 and not more than 45 years of age on the 6th of January, 1921.

Senior Draftsmen.

Senior Draftsmen at an initial salary of $1,680 per annum, which will be increased upon recommendation for efficient service at the rate of $120 per annum, until a maximum of $2,040 has been reached. This initial salary will be supplemented by whatever bonus is provided by law.

Duties.—To draw difficult maps and plans; to plot survey and field notes; in some cases to supervise the work of a small drafting staff; and to perform other related work as required, such as preparing drawings of complicated and important engineering structures; compiling maps and charts for various departmental reports and records; estimating quantities; computing areas; drawing up specifications; designing special appliances for construction work; laying out and checking the work of other draftsmen.

Timber Testers.

Two Timber Testers for the Forest Products Laboratories of Canada, Department of the Interior, at Montreal, at an initial salary of $1,440 per annum, which will be increased upon recommendation for efficient service at the rate of $60 per annum, until a maximum of $1,620 has been reached. This initial salary will be supplemented by whatever bonus is provided by law.

Duties.—Under direction, to operate timber a testing machine and make laboratory tests of timber; to plan and lay out areas of wood for testing purposes; to supervise carpenters in the preparation of testing materials; to weight and measure wood used for testing purposes; to plot load deformation curves; to observe physical changes in wood under test; to weigh moisture discs; to make slide rule computations, planimeter estimates of areas, measurements of deflections and load deformation diagrams, and other compurations of timber tests; to direct assistant testing machine operators; and to perform other related work as required.

Qualifications.—Education equivalent to graduation in forestry, science or engineering, from a university of recognized standing, or high school graduation and three years' experience in testing timber; knowledge of laboratory methods, familiarity with the use of computing devices, supervisory ability. Candidates must be 21 and not more than 45 years of age on the 6th of January, 1921.

Preference will be given to the residents of the Province of Quebec.

General Directions.

Application forms properly filled in must be filed in the office of the Civil Service Commission not later than January 6, 1921. Application forms may be obtained from the offices of the Employment Service of Canada, or from the Secretary of the Civil Service Commission, Ottawa.

By Order of the Commission,
W. Foran,
Secretary.

Situations Wanted

Engineer

Engineer. A.M.E.I.C. Technical training in civil and mechanical Engineering. 9 years field and office work on railroad construction, maintenance of way, bridge and building, signalling and interlocking and structural steel work; is open for position. Box 46-P.

Engineer

Engineer, A.M.E.I.C., 34. 14 years experience civil and mechanical engineering, including railway location and construction, foundations, erection, factory work, manufacture, operation, production, layout, pulp mill construction and power development, mining, management, purchasing and selling. Considerable executive experience, good handler of men, strong and active. Open for position about January 10th, 1921. Box 47-P.

Civil Engineer

Civil Engineer, age 25 years, wishes to locate with growing contracting concern. Has 3 years experience as instrumentman, estimator and designer. At present with large American fabricating company. Returned man. References and detailed statement of experience furnished. Salary expected, $200.00 per month. Box 48-P.

* * *

Members Exchange

FOR SALE, second-hand 12" Dumpy Level by Baker, London, complete with tripod. Price $60.00. An old but excellent instrument, with particularly good lenses. Box 10-A.

OBITUARY

Owen McKay, M.E.I.C.

Owen McKay, M.E.I.C., one of the outstanding civil engineers of Ontario and for 33 years a resident of the Border Cities, died on the afternoon of December 7th at Guelph, aged 74 years.

Mr. McKay was born in the county of Renfrew, near Pembroke, and came to Windsor in 1887. He graduated from the University of Toronto in civil engineering and practised his profession in Windsor until taken ill several months ago.

He was the engineer of Walkerville, Ford, Sandwich East, Sandwich South and other municipalities in this district and had been a member of *The Engineering Institute of Canada* since 1903. For some years he had been a member of the board of examiners of the Ontario Land Surveyor.

He stood high in his profession, and in his life time was entrusted with many important tasks. He was associated for years with the late Joseph DeGurse, and upon the death of the latter was appointed chief engineer of the Lake Erie and Detroit River railway. When this road was taken over by the Pere Marquette in 1902 he remained with the company until the Canadian division was amalgamated with the parent system in the United States, when he resigned and was appointed chief engineer of the Essex Terminal Railway, which position he retained until incapacitated by illness. Mr. McKay was elected a Member of *The Engineering Institute* April 23rd, 1903.

Speaking of the death of Mr. McKay, William Wollatt, Sr., who was general manager of the Lake Erie and Detroit River Railway, at the time of his appointment as chief engineer, and who, as vice-president and general manager of the Essex Terminal Railway, was later associated with Mr. McKay during his long period of service with that line, paid a high tribute to his ability as a civil engineer, his worth as a public-spirited citizen and as a friend.

"He was one of the finest engineers in the province and leaves a splendid record of achievement,"

* * *

Addresses Wanted

From time to time members have kindly co-operated with the Secretary's office in assisting to locate members whose addresses were unknown. It is desirable to keep our lists in the best possible condition. A list of the Associate Members, Juniors, Students and Associates whose present addresses are unknown is published herewith, and any information that will enable the office to get once more in touch with the men whose names are given will be greatly appreciated.

Associate Members.

Adamson, E. Kinnear
Annereau, Louis, Capt.
Archibald, Harry P.
Armstrong, Westropp, Maj.
Barry, David, Major
Barton, Robt. A. Lieut.
Beck, Herbert Philip
Bell, Chas. Burnby
Benedict, Elmore M.
Bishop, Reginald W.
Black, Wm. D.
Bowie, Jas.
Burnett, Archibald
Busso, Ed. Guiseppe Mario
Chappell, Frank, Lieut.
Charlton, Richard M.
Clarke, Ernest R.
Cowley, Francis P. V., Maj.
Dawson, F. J.
Ellis, J. G. St. J. (Reported to have been killed in action)
Elliot, John S.
Flanagan, O. L.
Flood, John Garner
Galbraith, J. S., Lieut., M.C.
Girouard, Rene A., Lt.-Col.
Grant, LeRoy Fraser, Major
Gunn, Luther Collins
Gunn, William W.
Hawkins, Edward Evan, Major
Hawkins, Leonard K.
Hay, Norman Kyle
Herbert, Henry Francis
Keefer, Edward C.
King, John L.
Kolling, Peter Ingvar
Krum, Karl O. W.
Laforest, G. B.
Langlais, Zaetree
Lefebvre, J. V. Stanislas
Lightfoot, Francis A.
Lowden, Norman, Lieut.
MacDonald, John
MacKay, Angus G.
MacLachlan, Jas. B., Lieut.
Martin, Louis A.
McDougall, Alex. L. Major
McKenzie, Jas. E.
McKillop, Robt., Capt.
Mitchell, A. K.
Muirhead, Thomas, Lieut.
Nowlan, Arthur
O'Born, Stanley Mill
O'Leary, H. Gordon
Payne, Caleb
Perkins, Harry William
Perry, K. M., Major, D.S.O.
Plumb, Maurice Wm.
Ritchie, Alan B., Major, M.C.
Ross, Chas. Raymond
Serson, Harold Victor, Lieut.
Smith, Herbert Neville
Stevenson, William F., Lieut.
Van Every, Wm. Wishart
Waldron, Stanley M.
Walker, T. Molineux, Capt.
Watts, Alfred Douglas, Major
White, Robert
Wilson, Norman D.
Yandall, Byron Angus
Younger, H. R.

Juniors.

Allan, John
Allen, Leonard E., Lieut.
Arsenault, Albert
Bathen, J.
Bennett, Geo. A.
Booth, C. D. G.
Bourque, L. L.
Brakeley, P. H.
Bryant, E.
Buckley, P. B., Capt.
Burton, E. C.
Cadieux, H.
Campbell, C. D.
Campbell, W. I. H.
Clark, C. R.
Clendinning, James
Cockburn, L. S.
Dansereau, J. A.
deCardaillac, G.
Dixon, G. B.
Draper, W. H.
Edwards, J. L.
Estrup, H. F.
Ewart, McLaren
Fairn, A. S., Capt.
Forest, Albert
Fortier, A. V.
Fulnecky, C. G.
Gauvreau, J. Roméo
George, W. B.
Goudie, Walter D.
Greening, E. O.
Hamilton, J. R.
Holland, H. D.
Houston, J. A.
Hughes, H. C.
Johnston, G. B.
Jones, John H., Lieut. (Reported missing)
Junkin, R. L., Capt. M.C.
Keefer, J. A.
Lacroix, P. A.
Laliberté, J. A.
Lamb, G. J.
Laurence, W. S., Lieut.
Legris, J. A.
Leishman, J. A.
MacQuarrie, E. MacG.
McKnight, Robt.
McNeil, O. M., Lieut.
Millican, A. G.
Mills, L. G.
Mitchell, J. Cameron, Capt.
Moody, F. H., Major
Moran, J. P., Lieut.
Morrisey, H. F.
Moxon, G. B.
O'Neil, H. J.
Passy, P. de Lacy D., Capt.
Patenaude, J. T. X.
Perron, H. M.
Pickard, H. G.
Poitras, E.
Read, C. G.
Richardson, C. E.
Ross, H. T.
Roy, Alfred
Rust, Frederick C.
Searanche, F. K.
Shawcross, R. H.
Shepherd, H. W. R.
Stewart, H. W., Lieut.
Taylor, W. H.
Theriault, A., Major
Wetmore, F. W. C.
Willrich, E. G., Lieut.
Worthington, A. N., Major
Wright, Leslie A.

Associates.

Bate, Wm. C., Capt. M.C.
Dyke, H. F.
Larkin, H. E.
Money, K. E.
Robertson, Geo.
Willis, T. A.

PERSONALS

E. M. Slater, A.M.E.I.C., is now with the Imperial Oil Ltd., Ioco, B.C.

*

C. N. Mitchell, Jr., A.M.E.I.C., is now with the Foundation Co., Chicago.

*

F. P. Adams, A.M.E.I.C., has been appointed city engineer of Brantford, Ontario.

*

K. C. Berney, A.M.E.I.C., is now with the Robbins & Myers Co., Springfield, Ohio.

*

J. H. Holliday, M.E.I.C., is at present with the Bedford Construction Co., Ltd., Halifax, N.S.

*

Chas. Robertson, A.M.E.I.C., has recently joined the firm of Schultz Co., Ltd., at Brantford, Ont.

*

Henry Goldmark, M.E.I.C., has been appointed vice-president, Goethals, Wells & Company, Inc., New York.

*

J. H. Hooper, A.M.E.I.C., has been appointed chief engineer of the Standard Steel Co , Ltd., at Welland, Ont.

*

W. Bowden, A.M.E.I.C., is at present resident in Seattle, Washington, in connection with the Bowden Engineering Company.

*

John A. Cooper, J.E.I.C., left for England recently, sailing from Halifax and expects to remain in England for the next five or six months.

*

A. G. L. McNaughton, A.M.E.I.C., sailed for Egnland recently on the C.P.O.S. Victorian and expects to be away from Canada for about a year.

*

F. M. Buchanan, A.M.E.I.C., has recently been appointed chief engineer of the Dominion Tar and Chemical Company Limited, Montreal.

*

F. W. Forbes, A.M.E.I.C., division engineer, Provincial Highways Board of Nova Scotia, has been transferred from Trenton, N.S. to Bridgewater, N.S.

*

M. R. Meldrum, M.E.I.C., formerly vice-president of The Herbert Morris Crane & Hoist Company Limited has been elected president of the same company.

E. Victor Deverall, A.M.E.I.C., formerly with the Dominion Bridge Co., Ltd., Toronto, has accepted a position with the Hamilton Bridge Co., Ltd., Hamilton, Ont.

*

A. D. W. Cuthbert, A.M.E.I.C., formerly of New Glasgow, N.S., has been appointed assistant engineer, Canadian National Railways, Champlain Market Station, Quebec.

*

A. A. MacDiarmid, A.M.E.I.C., formerly with the Ironsides Board Corpn., Norwich, Conn., is now doing consulting work in connection with pulp and paper mill engineering.

*

W. R. Devenish, A.M.E.I.C., superintendent of the Moncton division, C.N.R. at Moncton, N.B., has been appointed general superintendent of the Ontario district, with offices at Toronto.

*

J. Gordon Jack, A.M.E.I.C., formerly with the Hamilton Bridge Works Co., Ltd., has taken up contracting work in Toronto, and expects to continue in this business for some time to come.

*

Major H. R. Lynn, A.M.E.I.C., late of the engineering staff of Fraser Brace Co. Ltd., Montreal, has accepted a position with The Maple Leaf Asbestos Corp., Thetford Mines, P.Q., as resident engineer.

*

R. Lawrence Weldon, J.E.I.C., has recently resigned as resident engineer for the Fort Francis Pulp & Paper Company, to become mechanical engineer for the Three Rivers Pulp & Paper Co., at Montreal.

*

W. L. Reford Stewart, S.E.I.C., has resigned his position with Lockwood Greene & Co., Ltd., and has accepted a position with the Abitibi Power & Paper Co., Ltd., on the construction on a large dam at Twin Falls, Ont.

*

P. E. Doncaster, M.E.I.C., was appointed in March, 1920, to take charge of the Skeena district of British Columbia for the Dominion Department of Public Works. This district extends north of the 51st parallel of latitude, and includes an area of half a million square miles, with a coast line of 2000 miles of tidal waters. Apart from the usual work of river patrols for snags and debris affecting the fishing industry of the Skeena and Naas Rivers, ordinary wharf construction and repairs, Mr. Doncaster had some very interesting experiences in special river works in the northern part of the district.

The most interesting journey was an examination trip into the Peace River country. Starting at Fort George, B.C., a 40 mile portage was made into Summit Lake, thence by skiff and canoe down the Crooked Pack and Parsnips Rivers to the headwaters of the Peace River at Finlay Forks. From Finlay Forks the journey was continued down the Peace to the Great Canyon in a skiff. This part of the journey was followed by a 14 mile portage over waggon road, thence down to Peace River Crossing in a scow propelled by a small gas launch. Arrived at Peace River Crossing the journey back to Prince Rupert commenced by a novelty ride in the newly constructed Edmonton Dunvegan and British Columbia Railway, thence by the main line of the G.T.P. Rly., home.

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J. M. R. FAIRBAIRN, M.E.I.C.
President-Elect for 1921

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Canadian Battlefield Memorials

It has been announced that a competition will be held for the design of eight memorial monuments to be erected in France. The sites selected for these monuments are at points where Canadian troops were engaged in important battles which resulted in valuable victories for the Allied forces. They are as follows: St. Julien, Hill 62, (near Observatory Ridge), Courcelette, Vimy Ridge, Passchendaele, Hospital Wood, Dury Cross Road, Bourlon Wood.

The work is to be undertaken by an Honorable Commission, *The Institute* being represented in the person of Lieut. Colonel R. W. Leonard, M.E.I.C. At the organization meeting held recently approval was given to conditions for the competition, which is open to all Canadians, architects, artists, and others interested; an approximate cost of $120,000 being indicated for each monument. An important provision in the competition is that Canadians only can enter designs. It is hoped to have work well under way by October 1921, so that dedication may be possible by the autumn of 1922, possibly on Armistice Day.

A considerable amount of preliminary work in connection with the Battlefield Memorials has already been done in connection with the acquisition of sites, building roads to these sites, drainage and grading by Brig.-Gen. H. T. Hughes, M.E.I.C., who has been for some time in France engaged in this work; *The Institute* has received from Brig.-Gen. Hughes an interesting Christmas Card.

To the many members of *The Engineering Institute* who served overseas the work of the Canadian Battlefields Memorial Commission must be of great interest, and the Commission is to be congratulated on its stand in throwing its competition open to all Canadians, and to Canadians only.

BRANCH NEWS

Halifax Branch

F. R. Faulkner, M.E.I.C., Secretary-Treasurer.

The regular monthly meeting of the Halifax Branch was held in the supper room of the Green Lantern on Wednesday evening Dec. 15th at 6.00 p.m. Following the usual custom this was a supper meeting. At the conclusion of the supper, regular routine business was transacted.

The Chairman then introduced the speaker of the evening Col. W. E. Thompson, as one eminently fitted to speak on the water supply of the city of Halifax; a matter of vital importance to every one present, both as residents of the city and as engineers.

Col. Thompson said that he was very glad of the opportunity of addressing the Branch and expected that the discussion following his remarks would be beneficial to him.

The water system of Halifax presented difficulties on account of its age, the first system having been installed about 1847. The system now in use is divided into the high service and the low service, the high service supplying the higher part of the city and coming from the higher source, while the low service supplied the rest of the city including the business section. The maximum capacity of the watershed during dry weather flow is about 11,000,000 gals. per day, of which 9,000,000 is used in low service. Colonel Thompson thought that the entire amount was actually brought into the city and not lost in the mains on the way. Neither the city engineer nor his staff nor any of the consulting engineers who had investigated the supply had discovered any leaks large enough to account for any material loss.

The normal consumption in a city the size of Halifax according to accepted statistics should not exceed 100 gals. per capita per day including, all the water used for industrial and municipal purposes. But this 9,000,000 gals. per day in the low service gave a per capita consumption per day in 1916 of 333 gals. while in 1907 the figure was 462 gals. This shows an improvement in the piping service during the nine years and the reduction in per capita consumption may also be due to the installation of a large number of meters in this service, thus tending to reduce waste.

But even with this improvement the city is now using about 300 gals. per capita per day either in legitimate use, waste or leakage. The people are prone to blame some one for this wasteful consumption and the city engineer is the one who gets the blame. Col. Thompson felt it was injust to blame the city engineer, for, according to reports, he had been most active in calling the attention of the City Council to this condition and in advocating remedial measures. The fact that adequate remedial measures had not been adopted was ultimately the fault of the people, for if the public, and particularly public organizations and clubs, demanded that this condition be remedied, the city council would be compelled to vote the necessary funds.

One of the proposed remedies was the installation of meters. This had been done on the high service and although that service was not yet fully metered, the results would seem to justify their use. The available supply for that service, about 2,000,000 gals. per day had not been increased and while a few years ago there was an actual scarcity of water in that district, today with a large increase in population, the supply was equal to the demand, and a reservoir had been erected on Hungry Hill to absorb the surplus against a sudden large demand.

In view of the improvement in the high service, it has been decided to meter the low service and this is now being done. It is to be inferred that this would eliminate waste, and then if the surplus required for adequate fire protection could not be obtained, the deficiency could be laid to leakage and the necessary steps taken to stop that loss.

One reason for the present evident waste could be poor plumbing. The building laws were excellent, the plumbing laws were excellent, but unfortunately these laws were not rigidly enforced. A few infringements on these laws punished and advertised would do a great deal toward causing owners to remedy conditions.

However even with the improvement noted, there is not at this time enough for domestic, industrial and municipal purposes and fire fighting as well. Engineers could give the question careful study both as professional men and as citizens. It might be advisable to appoint a committee to investigate, publish a report, work for its adoption and in this way support the city engineer in his insistent demand for adequate remedial measures.

C. E. W. Dodwell, M.E.I.C., after expressing his personal appreciation of Col. Thompson's address, thought that one of the worst features of the present situation was the inability to enforce the plumbing and building laws. If the plumbing and piping were properly planned there would not be the same tendency to waste water in the winter when so many people left taps open to prevent freezing. He sympathized with the city engineer in his difficult position and felt that the branch should do all they could to impress the city council with the necessity of conserving the present supply. He then extended an invitation to the city engineer, F. W. W. Doane, M.E.I.C., to open the discussion.

Mr. Doane thought that Col. Thompson had shown a wonderful appreciation of the water situation in Halifax. The system had been designed many years ago and the peculiar topography of the city made it difficult. While it was the duty of the city officials to maintain an adequate and efficient water system there were many difficulties. The old mains were laid with wooden joints and while they might be poor joints it would cost a tremendous amount to replace them. There are some miles of uncoated pipes in the city and there is a certain amount of rusting and deterioration in these pipes, particularly when attacked by salt water, but there is less wearing out than is popularly supposed.

Since the high service had been metered, the per capita consumption per day in that service had fallen from 250 gals. to about 80. As for leakage, there could be no loss from that cause in the supply main because that main is regularly and carefully patrolled and any leaks are carefully located and immediately stopped. But leaks are more likely to occur in service mains and around valves, although during paving only twenty leaks had been found. An attempt rigidly to enforce the building laws and plumbing regulations is extremely difficult on account of civic politics, there was undoubtedly an illegitimate use of water due to poor plumbing and this was particularly true in tenements.

Further pertinent discussion was carried on by Messrs. W. A. Winfield, M.E.I.C., A. F. Dyer, A.M.E.I.C., W. P. Morrison, M.E.I.C., R. McColl, M.E.I.C., and H. W. L. Doane, A.M.E.I.C., following which the Chairman conveyed the thanks of the Branch to Col. Thompson with the assurance that if the Branch could be of any assistance in solving this problem, it would be glad to be of service.

The meeting then devoted itself to discussion of local professional matters and adjourned at 10.00 P.M.

Moncton Branch

M. J. Murphy, A.M.E.I.C., Secretary-Treasurer.

The regular monthly meeting of Moncton Branch was held in the Lecture Room of the Y.M.C.A. Building on Thursday, December 2nd. J. D. McBeath, M.E.I.C., Vice Chairman, presided.

At this meeting F. B. Tapley, M.E.I.C., W. B. MacKenzie, M.E.I.C., and F. West, A.M.E.I.C., were appointed a Committee of three, to meet with the Executive in recommending two members as a Salaries Committee to act in conjunction with a similar Committee from the St. John Branch.

A very interesting paper was read by F. H. Williams, A.M.E.I.C., on the "History and Survey of Electric Welding Methods" concluding with research work by the writer. This paper had previously been read by Mr. Williams at the Professional Meeting held in Halifax last

October, and was published in the November *Journal.* At our meeting the paper was illustrated with a series of fifty lantern slides of micro-photographs, showing the structural characteristics of welds, steel rails, boiler plates, etc., and the methods employed to improve the process of welding. Members present were also given an opportunity to study specimens under the microscope which Mr. Williams had at the meeting. The writer had many more photographs than those shown in Halifax.

S. B. Wass, A.M.E.I.C., in moving a vote of thanks to the writer called attention to the amount of work and study involved in the preparation of the paper.

W. B. MacKenzie, M.E.I.C., in seconding the vote of thanks, said that he had been quite agreeably surprised in hearing such a thorough description of the welding process, and that the engineering profession in Canada today required just such men as Mr. Williams.

R. Ambrose of the Mechanical Department, Canadian National Railways was tendered a vote of thanks for his assistance in running the lantern, which in no small way tended towards the success of the reading of Mr. Williams paper.

Moncton Branch is losing another of its most popular Members, in the person of W. R. Devenish, A.M.E.I.C., formerly superintendent of Moncton Division of the Canadian National Railways, who has been promoted to the position of general superintendent of the Ontario District, with headquarters at Toronto. Mr. Devenish joined the staff of the engineering department, Canadian Government Railways (now Canadian National) when he was appointed division engineer in 1913, with headquarters at Moncton, was promoted to principal assistant engineer in May 1915, and in November 1915 was again promoted to the position of superintendent, which position he held until his recent promotion to general superintendent of the Ontario Division. Mr. Devenish leaves Moncton with the best wishes of all.

Our members are looking forward with great interest to the postponed Luncheon Meetings which will now start in January; at these speakers will give short addresses on various subjects, and a musical programme will also be provided.

From present indications the Moncton Branch will greatly help to promote the welfare and standing of the engineers in our District, quite a number of whom have already sent in their application for membership to *The Institute.*

At a recent meeting of the Council of the Association of Professional Engineers at St. John, it was decided that the Annual Meeting be held on January 14th. It is expected the St. John and Moncton Branches will join in a social gathering on that date.

St. John Branch

Harry F. Bennett, A.M.E.I.C., Secretary-Treasurer.

At a meeting held in the Old Post Office Building on December 16th, G. G. Murdoch, M.E.I.C., presided and the following Branch members were present: Messrs. Murdoch, Hare, Steeves, Tapley, Johnston, Thomas, Holt, C. L. Archibald and H. F. Bennett.

Mr. Archibald reported for the Civic Centre Committee, that the Municipal Council was awaiting a draft bill from the County Secretary asking for authorization for the expenditure of money for competitive designs.

Mr. Tapley reported for the West Side School Committee, that they had visited the sites proposed and had selected one which, in their opinion was best suited for the location of a School Building. They had presented their views to the Common Council and the matter had not been taken up further by that body.

G. G. Hare, A.M.E.I.C., moved, seconded by A. G. Tapley, A.M.E.I.C., that a resolution of regret be sent F. P. Vaughan, M.E.I.C., at his inability to attend the meeting owing to illness and hoping that he would have a speedy recovery.

On account of the illness of Mr. Vaughan, no paper was read but general discussion took place on various matters.

The meeting adjourned at 9.15 p.m.

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Hydro-Electric Progress in New Brunswick

A conference was held in the Mayor's office, City Hall recently, when the question of the use by St. John of the hydro-electric power to be developed at Musquash was discussed. The various interests connected with the matter all had representatives present. Hon. W. E. Foster, premier of the province; Hon. Dr. E. A. Smith and C. O. Foss, M.E.I.C., of the New Brunswick Hydro-Electric Commission; Mayor Schofield, who presided; the four city commissioners; L. R. Ross and H. P. Robinson, representing the New Brunswick Power Company, were present.

Under the act by which the government is developing the water power of the province, it is stipulated that the power shall be offered to the various municipalities before being offered to private corporations and the premier made the offer to the city of the use of the power soon to be developed on the Musquash River. If the city accepted this offer, it was said, it would have to spend in the vicinity of $2,000,000 to install a distribution system for the current or turn the power over to the N. B. Power Company for distribution.

The meeting developed into an informal discussion of the question and several different phases of the matter were talked over. The N. B. Hydro-Electric Commission representatives put it up to the city that it was a matter between the city and the N. B. Power Company.

It was finally decided that an enquiry would be made into the cost of the current at present used by the N. B. Power Company and the difference of cost between the present current and that of the hydro-electric current will be computed. It will also be learned just what saving would accrue to the citizens by the use of the present distribution system, compared with the cost of the installation of a new system by the city.

At the present time there is a crew of more than one hundred men at work on the hydro-electric site at Musquash and much has been done in preparing the ground for the erection of buildings when construction commences early next spring.

The contract calls for the construction of a heavy concrete power dam on the East branch of the Musquash, some three thousand feet in length, and the construction of a grade on which to lay a ten foot wood stave pipe from the dam to the power house site at the head of tide near the Knight saw mill. It also calls for the construction of a concrete and earth dam, probably a concrete spill-way and earth approach, on the West branch of the Musquash, at the head of what is known as Scott's Falls, a mile from tide water. The construction of a short canal from Scott's Mills to the power house site and a minor run-around dam built of earth also is included in the contract.

The programme follows the opinion given last summer by C. O. Foss, M.E.I.C., that the Western branch of the Musquash could be diverted to meet the Eastern branch, bringing the power development seven or eight miles nearer St. John than the original Lepreau scheme. Tenders were opened on Thursday for the water-wheel and electrical generator for use at the power station.

The engineers and members of the commission are also preparing plans for storage dams, without which the whole scheme would be valueless. One large dam will be constructed at Log Falls, on the Western branch of the Musquash, and two smaller ones, at Seven Mile Lake and Sherwood Lake on the Eastern branch, as well as the very large storage provided by dams at the outlet of Loch Alva. At this point it is necessary to build a dam across the main outlet of the channel and also two additional large earth dams to prevent water running into the Belvidere stream at the east and into Deer Lake on the west.

Montreal Branch

J. L. Busfield, A.M.E.I.C., Secretary-Treasurer.

On November 18th, a very interesting paper was presented on The Heating and Ventilation of Paper Machine Rooms by E. A. Ryan, A.M.E.I.C., followed by a discussion in which E. A. Briner, consulting engineer, of East Orange, N.J., and J. Stadler, chief engineer, Belgo-Canadian Pulp and Paper Company, took an active part. There were present a number of representatives of the pulp and paper companies. Mr. Ryan's paper, together with Mr. Briner's discussion, is printed in this issue of *The Journal*.

At the meeting on the following week, at which Professor McKergow, M.E.I.C., presided, R. O. Sweezey, M.E.I.C., spoke on "Some Economic Aspects of Canadian Forest Resources". He stated that the Canadian forests were being depleted faster than they were growing, that wanton destruction still prevailed and that the forces of defence seemed to be totally inadequate. With regard to fire loss the author pointed out that despite recent precautions it was a fact that 75% of the present forested areas had been burned over during the past 200 years. That these areas had again grown to present good timber stands was an indication that nature had its own methods for perpetuation of forests. With the re-growth of burnt areas hardwood trees were gaining supremacy in the Canadian forests to the destruction of the soft and more valuable woods such as spruce, balsam and pine. With present conditions the lack of suitable woods threatened the pulp and paper industry of the United States owing to increased demand and reduced supply. None of the big Canadian companies were operating in the woods scientifically, and the author urged the adoption of more advanced and scientific methods of forestry work as well as methods of reforestation, since it took about 150 years to grow a spruce forest, from seed to maturity.

On December 2nd, A. Duperron, A.M.E.I.C., senior assistant to the chief engineer of the Quebec Streams Commission, read a paper on The Water Storage of the St. Francis River. In opening he described the River St. Francis as one of the Southern tributaries of the St. Lawrence, into which it flows at the head of Lake St. Peter. It runs through Drummondville, Richmond, Windsor Mills, Bromptonville, Sherbrooke and East Angus. The total fall of the river is 900 feet distributed through numerous falls and rapids; 200 feet of fall are at present developed by various companies and many other advantageous power sites will certainly be developed. In 1913 the Quebec Streams Commission received a petition from the power users along the St. Francis River and from officials of cities and towns located in its valley, asking the Commission to study the possibility of storing water in the upper St. Francis. In relation with storage reservoirs, it must be borne in mind that the conservation of water is only advisable where water powers are developed to such an extent that, from a financial point of view, real benefits can be obtained from the surplus of water thus available. After a complete study of the whole question, the Commission decided that a storage reservoir could be economically built in Lake St. Francis, in the County of Frontenac. By building a concrete dam at the outlet of this lake, raising the water 27 feet above low water, the run-off of the watershed which has an area of 472 square miles, could be stored and the outflow regulated to a minimum of 600 second feet, maintained constant throughout the whole year. The minimum natural flow of the lake in its natural condition was 100 second feet.

The Quebec Streams Commission also took the control of Lake Aylmer, 5 miles below Lake St. Francis, and by means of a timber dam obtain an additional regulated flow of 150 second feet. The amount of additional power due to storage is estimated at 7,450 horse power, and the whole cost of the works has amounted to about $700,000. The revenue required to pay the interest, a thirty year sinking fund and a reasonable amount for maintenance and incidental repairs is $56,000, and the water power owners who benefit from the surplus water are called upon to pay the whole of this revenue.

On December 9th, an address of much interest was given by J. Maxtone-Graham, president of the Scottish Spitsbergen Company, on the exploitation of Spitsbergen. He dealt with the early history of the island since its discovery in 1596 by Dutch explorers, and with its varied history of national conflicts and jealousies. The country was originally exploited for the fisheries particularly whale and walrus, but for the last century there has been very little fishing. After a visit to the archipelago by Dr. Bruce, the well-known arctic explorer, a syndicate was formed in Scotland for the further examination of the mineral resources, but no development work was done until after the war. In 1919 a large expedition was sent and examination made of the minerals which consist of magnetic iron ore, copper, asbestos, marble, shale and enormous quantities of good coal. The speaker illustrated his address with a large number of remarkable lantern slides and a reel of motion picture film. R. A. Ross, M.E.I.C., presided, and in addition to the large attendance of members there were many guests present.

The last meeting of the first part of the 1920-21 season was held on December 16th, at which a double programme was presented. The first part of the evening was taken up with the exhibition of a series of motion picture films, loaned by the Graton and Knight Manufacturing Company, illustrating the manufacture of leather belting from the live animal to the finished product. The important points were ably pointed out by Mr. Haggeman, the secretary of the company. The second part of the evening was devoted to a paper on Overall Thermal Efficiency in Everyday Engineering Practice, by G. Percy Cole, M.E.I.C., technical engineer of the Dominion Glass Company, in which paper the author not only reviewed thermal efficiency problems in all kinds of machines, including the human machine, but also showed a number of lantern slides of the machinery of a glass manufacturing plant.

Ottawa Branch

F. C. C. Lynch, A.E.I.C., Secretary-Treasurer.

"Methods of modern topographic surveying" was the subject of an interesting and instructive paper read by W. H. Boyd, chief topographer, Geological Survey, at a largely attended meeting of Ottawa branch, *Engineering Institute of Canada* in the Public Library, recently. Major A. F. Duguid, who had much experience in survey work during the war in France, gave an illustrated lecture upon the utilization of topographical surveying methods in photographing, plotting and making relief maps of enemy lines.

G. B. Dodge, M.E.I.C., who occupied the chair, stated that to Dr. Deville, Surveyor General, belongs the credit of practical utilization of photography in topographic survey work, and that Canada was the first country to make use of this valuable method of surveying otherwise practically inaccessible areas. Col. H. O. Osler paid a tribute to the great part geologists had played in the late war, as also did Major McCann, geologist of the Dominion Geological Survey.

Mr. Boyd emphasized the necessity of accuracy in topographical surveying. It was a question, he said, whether or not a poor survey with a good sketch was not better than a good survey with a poor sketch. He illustrated his lecture with a number of interesting lantern slides. A poor sketch could destroy the value of a map entirely.

Dr. Deville complimented Mr. Boyd upon the excellence of his paper. He also said that experiments had been conducted lately in airplane work with the camera, and it was probable that greater development in this direction would follow later. Mr. J. J. McArthur, chief of the Boundary Survey, recalled early days in the field.

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At a meeting of Ottawa Branch held on November 18th, J. S. Kingston, Mem. A.S.M.E., read an interesting paper on Coal Conservation. In his address Mr. Kingston mentioned that the demand for coal is increasing at the rate of 50,000,000 tons per year. The output of bituminous coal for the first 6 months of 1920 was 41,000,000 ahead of the same period last year, and anthracite was 3,400,000 tons ahead for the same period, yet the world' supply was 171,000,000 tons short. At this rate of consuming coal "which cannot be replaced" the time has arrived when we should consider how it may be conserved. It is agreed that 175,000,000 tons of coal are yearly wasted in power boiler furnaces.

Very many such furnaces are only 40-50% efficient, but where coal is burned on scientific lines 75-80% has been obtained from boiler plants. Cases could be cited where one boiler is doing the work formerly done by three boilers. Incrustation in boilers, also on water tubes of boilers of one quarter of an inch thick is responsible for 66% of waste of coal; very many steam boilers in factories only evaporate 5 lbs. of water per pound of coal that should be evaporating 9-10 lbs. of water per pound of coal.

Fire tubes of multitubular boilers are made as thin as safety will permit, but when even a quarter of an inch of scale or soot is allowed to remain on inside or outside the heat units from the water or coal will penetrate the walls of those tubes no faster than if they were one and one quarter of an inch thick. If only 10% of coal mined for one year in the States was burned to waste the quantity would require 206,000 trains to haul each of 25 cars, or 5,200,000 cars. With bituminous coal from our own mines, it was explained that 138,000 cars would be required on a 25% basis although several boiler trials have proved a 40-50% waste of coal.

Sectional cuts of multitubular and water tube boilers were thrown on the screen showing the path of products of combustion of coal in ordinary settings, also settings suggested for the saving of coal, also path of heat from coal. It was suggested as a solution for this waste and expense that the several provincial Governments see the necessity of educating the firemen and engineers of stationary boiler plants in the science of combustion of coal by pamphlets or night schools; city councils should also co-operate in such a cause.

Ontario Provincial Division

A. B. Lambe, M.E.I.C., Secretary.

At a meeting of the Executive Committee of the Ontario Provincial Division, held in the Engineers' Club, Toronto, on December 11th the following members of the Executive were present: Messrs. H. B. R. Craig, (in the Chair), Blanchard, Brian, Challies, Dobbin, Gray, Gillespie, Harkness, Lambe, Col. Magwood (by A. B. Lambe as proxy), Col. W. P. Wilgar, (as proxy for Col.

McPhail), Palmer, and Perry, and by invitation, Willis Chipman, H. A. Goldman, Fraser S. Keith, and R. O. Wynne-Roberts.

Matters of considerable importance to the Division were discussed, including action regarding the proposed legislation in Ontario.

After a vote of thanks for the time and thought which the two representatives of the Division on the Advisory Conference Committee, Messrs. Challies and Chipman had given to the work of promoting legislation in the Province it was resolved after considerable discussion that the present Advisory Conference Committee be authorized:—

(a) To have the Bill (Ontario proposed) printed and presented to the members of its several member societies.

(b) To take such steps as it deems necessary to bring the Bill before the members of the engineering profession in Ontario, and to obtain their approval thereof.

(c) To make such amendments to the Bill as it deems advisable, following any suggestions that may be made to it from time to time.

(d) To take the necessary action, following the approval of the Bill by the engineering profession in Ontario, to have the Bill introduced at the forthcoming session of the Ontario Legislature, and to insure its passage, if possible.

Questions regarding the finances of the Division, proposals in regard to changes in By-Laws, Branch representation, appointment of engineers to Ontario Government positions, Council meetings, and other matters were discussed and submitted to Council for consideration. A letter to Walter J. Francis, M.E.I.C., expressing the regret of the Committee on learning of his serious illness was authorized, the Secretary of the Committee being also asked to transmit to the Niagara Branch the thanks of the Division for the work of the Branch in connection with the General Professional Meeting held at Niagara Falls in September last.

Kingston Branch

W. P. Wilgar, M.E.I.C., Secretary-Treasurer.

A meeting of the Kingston Branch held at the college listened to a very instructive illustrated address on "Cement Mixtures" by Capt. F. M. Dawson, A.M.E.I.C., who is a member of the firm of Monks, Manhard and Dawson, consulting engineers, of Montreal.

Captain Dawson described how in ordinary cement mixing much of the cement powder did not mix with the water but remained in globules like wet flour. By the addition of a catacol to cement when it was being manufactured its mixing powers would be increased very much and a super-cement of much greater strength obtained.

The speaker was introduced by the Chairman of the Branch, J. M. Campbell, M.E.I.C. The interest taken by the audience was shown by the lengthy discussion which followed Capt. Dawson's address. A vote of thanks to the speaker was proposed by Mr. Sproule.

Peterborough Branch

R. L. Dobbin, M.E.I.C., Secretary-Treasurer.

The speaker at the regular meeting of the Branch on December 9th was Captain F. M. Dawson, A.M.E.I.C., of Toronto, who spoke on "Super Cement".

Captain Dawson described the manufacture of ordinary Portland Cement, and compared it with Super Cement. He showed many micro-photographs of concretes made from different kinds of cement, and demonstrated that, that made from Super Cement was more dense than others. He also proved that there was no loss in strength with the increase in density.

The audience present included not only members and affiliates of the local Branch, but also many local users of cement, practical men, who asked many questions. As a result much valuable information regarding both ordinary and Super Cement was brought out.

Toronto Branch

H. A. Goldman, A.M.E.I.C., Secretary-Treasurer

Nov. 18th —"Zoning" as part of Town Planning

As the work of the Committee which had been engaged on this matter was not complete, a review of matters brought before the Committee was presented for discussion.

H. L. Seymour, A.M.E.I.C., Chairman of the Committee, briefly outlined the history of Zoning and referred to existing and proposed legislation in various parts of Canada and the United States. The speaker said that Zoning was only a part of town planning, which may be defined as public control of private property in the interests of the health, safety and welfare of the people, or as one authority has defined it — the control under community power of (a) heights of buildings; (b) percentage of area of lots that may be covered with buildings; (c) the use to which buildings may be put on private property. The main advantages ascribed to Zoning include (1) permanent development of the area concerned; (2) suitable provision for adequate light, air and sanitary arrangements; (3) orderly growth of the city; (4) prevention of undue congestion; (5) stability of property values; (6) economies in public service utilities.

A number of slides were then shown to illustrate conditions resulting from lack of Zoning restrictions.

J. P. Hynes, architect, showed a few historically interesting slides of local plans prepared in the eighteenth century, which indicated that principles of Zoning had been recognized at that early date. He thought that more definite authority should be established to bring town planning activities into affect and to enforce restrictions. He deplored the lack of interest shown by engineers and architects in advocating the carrying out of civic betterments, such as would result from adequate town planning.

N. D. Wilson, A.M.E.I.C., showed interesting slides setting forth the results of traffic studies made in 1915 by the Civic Transportation Committee of Toronto.

H. B. Dunnington Grubb, landscape architect, suggested that any proper definition of Zoning should include a limit to the number of buildings per acre.

G. G. Powell, A.M.E.I.C., expressed the view that the attempt to apply Zoning to the older established parts of cities would give no better results than obtained at present, because the development of the city might be widely divergent from true town-planning principles. He thought that Zoning, generally speaking, makes for orderly development, but was by no means a cure-all for the ills of city growth.

Messrs. H. B. Dunnington-Grubb, W. E. B. Armstrong A. E. K. Bunnell also took part in the discussion.

Nov. 25th — Mesopotamia

L. W. Wynne-Roberts, A.M.E.I.C., delivered a popular illustrated lecture on Mesopotamia.

The speaker dealt mainly with the work of the Royal Engineers during the War and showed several examples of work accomplished with the scanty material and indifferent labour available by means of lantern slides.

Other slides were then thrown on the screen, which showed the construction of the great road to accommodate the retreat from Armenia and the Caspian, and also the remains of ancient engineering enterprises.

The illustrated lecture was highly appreciated by all present.

Dec. 2nd — Ethics — Progress of Committee

R. O. Wynne-Roberts, M.E.I.C., Chairman of the Branch, opened the meeting and requested Geo. Clark, A.M.E.I.C., to act as Chairman for the evening.

For several months a Committee of the Toronto Branch had been engaged in formulating a code of ethics for the engineering profession. In order to obtain the opinions of the members, the entire meeting was devoted to an open discussion of the various phases of the proposed code.

T. D. Mylrea, A.M.E.I.C., Chairman of the Committee on Ethics, said that it was the desire of the Committee to formulate a code broad enough in scope to apply to all engineers. In view of this, the Committee had adopted Dr. J. A. L. Waddell's classification of the duties of a professional engineer as follows: His relation (1) to the public; (2) to the profession; (3) to his fellow engineer; (4) to his clients; (5) to his subordinates and superiors; (6) to contractors and (7) to himself. The various detailed phases of most of the above relations were discussed and some suggestions for changes were made.

The Committee felt that while the engineer owed it to himself, to the profession and the general public to fulfil all of the duties outlined in the code, yet only a part of them could be made compulsory, the remainder would serve merely as a guide for professional conduct. It was proposed, therefore, to divide the new code of ethics into two parts: (1) compulsory clauses or by-laws, and (2) recommended clauses or guides. The by-laws will be designed to prevent deliberate wrong doing by the engineer. In order to make them effective, various penalties have been proposed, which would be enforced by the Council of *The Institute* and the Executive of the Provincial division.

Further discussion of this proposed code will be heard at a meeting in the near future.

The members of the Committee on Ethics were T. D. Mylrea, A.M.E.I.C., (Chairman), H. A. Goldman, A.M.E.I.C., (Secretary), W. E. Douglas, A.M.E.I.C., J. C. Krumm, A.M.E.I.C., H. J. Lamb, M.E.I.C., R. O. Wynne-Roberts, M.E.I.C., C. R. Young, M.E.I.C.

Dec. 9th — Peat Fuel

B. F. Haanel, M.E.I.C., of Ottawa, who was to have addressed the Branch on the topic was unable to attend, but sent his paper on Peat Fuel, which was presented to the meeting by R. O. Wynne-Roberts, M.E.I.C., Chairman of the Branch.

Mr. Haanel estimated that the Peat Crop of Canada contained at least nine billion tons of peat. While at present Canada's supply could not yet be utilized to prove a great commercial success, although he pointed out that the most modern methods for development were in use. Sweden, Italy and Germany have been successful in putting Peat Fuel on a paying basis. This is due to the fact that those countries had furnaces specially constructed for the use of Peat. Canada's product was, however, up to the standard produced in Europe.

Dec. 16th — The Relation of Labour and the Engineer to Public Improvement

Arthur W. Roebuck in speaking about the relation of labour and the engineer to public improvement said that he recognized the limitations placed upon the engineer by inadequate apportionment for expenditure. However, he pleaded for better conditions for labour in order to win the efficient co-operation of the workers for the ultimate success of the project.

He contended that there was something wrong with the present system of financing public improvements. The benefits from all public enterprises could be classed under two heads: (1) local and (2) general. The sound and logical basis for all financing of public works was that the cost of building any public improvement should be paid for out of the profits directly accruing from the enterprise. If the principle of dividing the cost of a public enterprise between the districts benefiting directly and the general public who benefited indirectly and in amounts proportionate to the benefits, a great stimulus would be given to civic development. He gave several examples to show that increased values and new wealth had been created as a result of well planned development and that the public benefits had been so enormous as to completely over-shadow the initial expenditure.

Mr. Bengough, combining humour, wit and eloquence, expressed opinion that any increase in land values was due only to the movement of population.

Frank Barber, A.M.E.I.C., H. E. T. Haultain, M.E.I.C., J. M. Oxley, A.M.E.I.C., P. Gillespie, M.E.I.C., and Mr. Winkler touched briefly on various phases of the subject.

It is to be hoped that more addresses of this nature will be presented at future meetings.

Hamilton Branch

J. A. McFarlane, M.E.I.C., Secretary-Treasurer.

The Annual Banquet of the Hamilton Branch, held in the Royal Connaught Hotel on the evening of Dec. 10th proved to be one of the most successful meetings in the history of the Branch. The attendance was good, eighty members being present. Dinner was served at 6.45 P.M. with H. U. Hart, M.E.I.C., Chairman, presiding. A good musical programme was given by Messrs. McCutcheon, Codling, Pronin and McMillan and enjoyed by all present. The only toast "The King" was responded to by the singing of the National Anthem.

H. U. Hart, M.E.I.C., Chairman, spoke briefly as follows:—

"Fellow Members of *The Engineering Institute of Canada*, this is the first dinner of the year and I wish to take this opportunity of saying a few words about the work of our Hamilton Branch of the E.I.C.

The Executive Committee have attended in a splendid manner, the various meetings of the Committee and have displayed much zeal in the work of *The Institute*.

We now have a total list of 125 connected with *The Institute*, which includes 14 Members, 41 Associate Members, 10 Juniors, 19 Students and 45 Affiliates. This is an increase of 20% over last year. I wish to congratulate Mr. Paulin, who is chairman of the Membership Committee, and also his co-workers. On looking over this list I see there are a number of Affiliates and Juniors who, by their experience, are qualified for higher rank in *The Institute* and we would like to see them make application for higher grade.

There is an advantage of having a national society composed of mechanical, civil and electrical engineers, as our numbers in Canada are too small to have separate organizations. Our views are broadened by having addresses on other lines of engineering work. The outline of work for this season is to have one or two "get together" dinners and, say a high grade engineering paper on a subject of interest during each month of the winter. Mr. Dwight of our Papers Committee, expects to have noted engineers address us this winter and, due to our limited membership, we would like to have a full turnout at every meeting, in order to encourage the speakers.

I venture to say that on any large engineering work in the City, some of our members are actively engaged in the work. We have a common bond and let us together make this society a power for influence in our City and Country."

Mr. Hart then introduced Fraser S. Keith, A.M.E.I.C., general secretary of *The Engineering Institute of Canada*, who congratulated the Branch on the splendid progress it was making in increased membership and interest in the welfare of *The Institute* as a whole. He stated that it was a pleasure to him to be present and meet so many members of the Hamilton Branch. He gave an interesting talk on Institute matters, sketching briefly the history of *The Institute* from its first inception to the present time and describing in detail the organization in all its various ramifications from Council down to Branches. The formation of Pranches had proved to be a forward step and was proving a great benefit to *The Institute* as a whole. The speaker told of the work at headquarters — the staff required and the duties of the Secretary in order to carry on the routine work. *The Journal* came in for a full share of praise, and particular reference was made to the Engineering Index which was one of the best in the world. Reference was made to Legislation, the results accomplished to date, and the Policy of *The Institute* for the future. Many questions of vital interest to engineers were referred to by the speaker who paid a glowing tribute to the good work being accomplished by the Branches. A vote of thanks was tendered Mr. Keith for his interesting address.

Mr. Hart next introduced the speaker of the evening J. W. Tyrrell, C.E., M.E.I.C., who gave an illustrated address on The Hudson Bay Route and its Development to date.

It was pointed out, to begin with, that the success or failure of such a project would depend primarily upon two conditions, the first being, the local resources of the district and the second, the selection of the route and terminals.

As to the local resources of the country, they were described in considerable detail and illustrated by numerous lantern slides made from Mr. Tyrrell's own photographs; and the conclusions arrived at were that the resources of Hudson Bay District, together with the through traffic to be derived from the shipments of grain to the markets of Europe, were quite sufficient to warrant the building of a railway to the shores of Hudson Bay and the establishment of a steamboat route from thence through the Bay and Strait to connect with the Atlantic Route.

As to the selection of the route and terminals, some very interesting statements were made and these were supported by personal surveys and charts made by the speaker, as well as having been reported by him upon several former occasions — The gist of these reports being strongly in favour of Churchill as the Railway terminus and Sea Port because of its natural fitness for such purpose.

A hearty vote of thanks was tendered Mr. Tyrrell for his splendid paper.

R. K. Palmer, M.E.I.C., was elected Branch Representative to the Ontario Provincial Division for the year 1921.

Eleven applications for admission to *The Institute* were handed Mr. Keith during the evening. Nine new subscriptions to *The Journal* were also handed to Mr. Keith, all being secured from the new affiliates. The Membership Committee is certainly doing good work.

The Hamilton Branch has now 48 affiliates. This was referred to by Mr. Keith, who stated that this was the largest number of affiliate members in any single Branch in Canada.

Mr. Tyrrell's paper will be published in full in *The Journal* at a future date.

Border Cities Branch

J. E. Porter, A.M.E.I.C., Secretary-Treasurer.

A sumptuous dinner was the opening number on the programme of the Annual Meeting of the Branch, held in the Auditorium of the Chamber of Commerce, Friday evening, Dec. 10th, 1920.

Ample evidence of the progress of the branch was shown by the largest percentage of the membership present in its history.

After dinner, H. B. R. Craig, M.E.I.C., Chairman, opened the business of the evening. A silent toast was drunk in memory of the four members who had passed to the Great Beyond in the past year. Several new members were tendered a hearty welcome. The reports of the Officers and Chairmen of Committees were then received and adopted.

The next business of the meeting was the election of officers for the ensuing year, the results being as follows: Chairman: A. J. Riddell, A.M.E.I.C.; Secretary-Treasurer: J.E. Porter, A.M.E.I.C.; Executive Committee: H.Thorne, M.E.I.C., M. E. Brian, A.M.E.I.C., J. J. Newman, M.E.I.C.

Considerable time was devoted to analyzing the ten points on Policy as outlined by Mr. Wynne-Roberts of the Toronto Branch. The general consensus of opinion was as follows:—

1. That every effort should be put forth to obtain legislation, develop a code of ethics, and then the matter of adequate remuneration could be dealt with in a satisfactory manner.
2. That present titles are not sufficiently expressive, and that more definite grading should be set down.
3. That all members resident in Canada should be attached to Branches, regardless of location of residence.
4. It was felt that much of the routine work of Council could be handled by the Branches, giving Council valuable time to devote to matters of greater importance.
5. That the Branches should be training schools, service thereat being an essential qualification for election to all offices.
6. That dues should be increased to the extent that sufficient funds will be available so that *The Institute* may carry on aggressively and effectively.
7. That recognized technical societies should be encouraged to affiliate with *The Institute.*
8. That *The Institute* should take a more prominent part in the promotion of engineering enterprises.
9. That *The Institute* should urge the importance of appointing engineers on Commissions or investigations concerning matters relating to Engineering.
10. That *The Institute* should adopt a policy of participating in work which has for its object the improvement of the country's social fabric.

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Notice of the death of Owen McKay, M.E.I.C., which occurred during the previous week was received with deepest regret. Mr. McKay was a highly esteemed member of the Branch and his passing removes one of the pioneers in engineering in this vicinity.

A special vote of thanks was given to the retiring executive for their untiring efforts in the interests of the Branch during the past year.

Sault Ste Marie Branch

Geo. H. Kohl, A.M.E.I.C., Secretary-Treasurer.

The Sault Ste Marie Branch meets on the last Thursday in each month. The first meeting of the 1920-21 season was held on October 26th in the Board Room of the Algoma Steel Corporation. L. L. Jacobs, A.M.E.I.C., Chairman of the Branch, called the meeting to order at 8.15, and after a few routine matters had been attended to, introduced C. H. E. Rounthwaite, A.M.E.I.C., engineer of the Algoma Central & Hudson Bay Railway, who then presented a very interesting paper on "The History of the Engineering Works in and around the Sault" dealing especially with the old North-West Company's Lock. This old lock was the first to be built on this Continent and was constructed in 1797-98 by the North-West Company to facilitate getting their bateaux above St. Mary's Rapids. The lock was partially destroyed in 1814 when a party of 150 Americans attacked the Trading Post and set fire to it. It was not rebuilt until The Spanish River Pulp & Paper Mills, whose Sault Ste Marie mill stands on the site of the old canal, restored the lock in accordance with the descriptions found in the Canadian Archives.

The postponed November meeting was held on December 2nd with L. L. Jacobs, A.M.E.I.C., in the chair. The resignation of H. S. Grove, A.M.E.I.C., from the Branch executive, due to his temporarily leaving the city, was accepted, and L. R. Brown, A.M.E.I.C., elected to fill the vacancy. F. M. Perry, A.M.E.I.C., was then re-elected to represent the branch in the Ontario Provincial Division. Mr. Jacobs then presented a very able and interesting paper on "Purchasing".

Owing to the next regular date for meeting falling between Christmas and New Year's, it was decided to hold it on December 16th. The meeting was called to order at 8.15, Geo. H. Kohl, A.M.E.I.C., in the chair. After routine matters had been attended to the Secretary announced that owing to the author suddenly leaving town the paper intended for that meeting could not be given. In its place a speech by Herbert Hoover on the Labour question was read, and brought out a good deal of interesting discussion. The next Branch meeting will be held on January 27th.

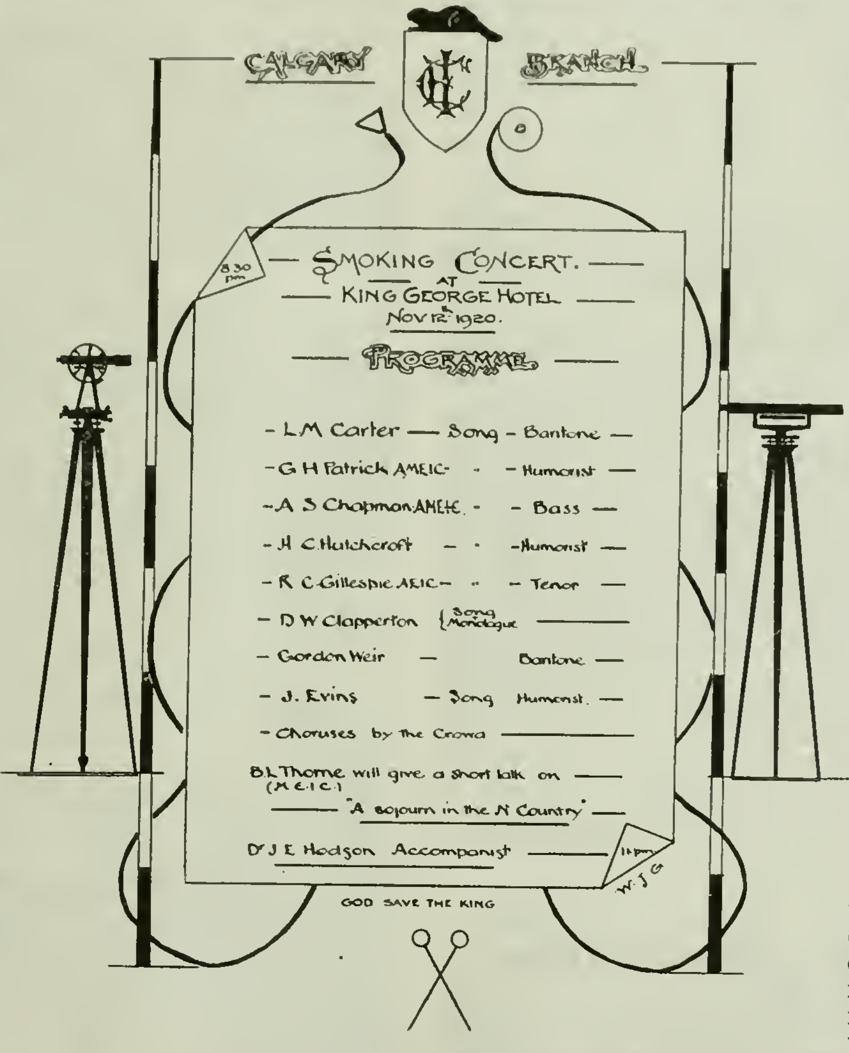
Winnipeg Branch

Geo. L. Guy, M.E.I.C., Secretary-Treasurer.

At the regular meeting of the Branch, held on 13th. November at the University Building with W. M. Scott, M.E.I.C., in the chair, a paper was presented by George L. Guy, M.E.I.C., entitled "Some Principles of Rate Making".

The paper dealt with the general principles involved in fixing the rate for public utilities, emphasis being laid upon the necessity for adequate depreciation being allowed for, and a discussion of the various methods at present used in estimating depreciation. The paper was of very great interest, owing to the recent application of the Winnipeg Electric Railway Company for increased railway fares and the valuation and decision of the Public Utilities Commission of Manitoba in the case. Mr. Guy, being engineer for the Commission and having had charge of the work carried out by W. M. Scott, M.E.I.C., was particularly competent to address the Branch on the subject and the paper was of great interest to the members and should prove a valuable contribution to the literature on the subject

The discussion was entered into by many present and the differences of opinion which were brought out in the discussion emphazised the necessity for a proper study of the various features which go to make up the final cost of a public utility operation.



CALGARY BRANCH

8.30 pm

SMOKING CONCERT.
AT
KING GEORGE HOTEL
NOV 12th 1920.

PROGRAMME

- L M Carter — Song - Bantone —
- G H Patrick AMEIC - " - Humorist —
- A S Chapman AMEIC. - - Bass —
- H C Hutchcroft — " - Humorist —
- R C Gillespie AEIC - " - Tenor —
- D W Clapperton {Song
Monologue —
- Gordon Weir — Bantone —
- J. Evins — Song Humorist. —
- Choruses by the Crowd —

B L Thorne will give a short talk on —
(M.E.I.C.)
— "A sojourn in the N Country" —

Dr J E Hodgson Accompanist —

11 pm

W.J.G.

GOD SAVE THE KING

A hearty vote of thanks was moved by J. M. Lemay, M.E.I.C., and seconded by A. W. Smith, A.M.E.I.C.

The main business transacted at the meeting was the appointment of the Chairman, Mr. Scott, to attend the Annual Meeting in Toronto, representing the Manitoba Branch. It was also decided to send an invitation to *The Institute* to hold their 1922 Annual Meeting in Winnipeg.

On 18th. November Professor Martin, Professor of History, Manitoba University, gave an address to the members of the Branch on "The Rights to our Natural Resources". In view of the prominent position this subject is now taking in political discussion in the West, the address was very opportune and was appreciated by the members present.

Professor Martin dealt with the alienation of the natural resources of the Western Provinces from the time of the purchase of Prince Rupert's Land by the Imperial Government, and traced the action of the Federal Government in connection with this matter through Confederation and up to the present time.

He made a strong plea for the assistance of all the members in securing just treatment for the Prairie Provinces and was assured of the full support of the Branch in this matter.

A very interesting discussion took place after the address, in which Professor Martin enlightened the members upon many points with which they were not quite familiar. A hearty vote of thanks was passed and Professor Martin was assured of the co-operation of the Branch in every way.

To express their appreciation of the honour done to General Ruttan in being elected Honorary Member of *The Institute*, a vote of appreciation was passed by the Branch, and the Secretary instructed to write to General Ruttan and to Headquarters expressing the appreciation of the Branch of the action of Headquarters in this matter.

On 2nd. December at the regular meeting of the Branch a discussion on Professor Dorsey's paper "Power Transmission" was continued.

Professor Dorsey demonstrated by experiment the losses occurring due to corona on wires when the critical value is reached and also demonstrated the slight effect the difference in spacing made on this loss. The speaker requested that the discussion take place under three heads: first, economy and desirability of high voltage D.C. for transmission purposes; second, means of producing high voltage direct current and, third, switching, lightning protection and other features which would enter into the problem.

He replied in detail to the discussion which had taken place at the previous meeting and dwelt at length upon the losses due to corona in A.C. systems and the limitation of voltage imposed by these losses. He also further emphasized the increased efficiency of direct current over alternating current transmission. The discussion which took place on this subject indicated that the members were perfectly in accord with the speaker in the desirability of direct current transmission, provided it were possible to generate direct current at suitable pressures for long distance transmission, and there was nothing brought out in the discussion which would tend to indicate any opposition to this method of transmission, provided the generating and distribution end could be taken care of.

Professor Dorsey then dealt with his scheme for producing high voltage direct current; his main feature consisted of the use of mercury arc rectifiers for producing commutation of the current in the coils undergoing reversal. He suggested two methods, one using an open coil winding and the other using a closed coil winding. By means of diagrams he demonstrated the elementary principles of his system and explained the advantages which he claimed for this method of commutation. The discussion on this part of the subject was entered into by a large number of the members present. The difficulties of switching, lightning protection and other features were also thoroughly discussed.

The meeting closed with a hearty vote of thanks to Professor Dorsey for his original contribution to the proceedings and, while the general opinion was that the system of generation proposed had not been sufficiently demonstrated to prove its possibilities, the Branch wished him every success in his further researches.

The meeting closed with a vote of thanks proposed by J. G. Sullivan, M.E.I.C.

W. M. Scott, M.E.I.C., Chairman of the Branch, presided.

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Registration for the Association of Professional Engineers for the Province of Manitoba is now proceeding rapidly, over 200 applications for registration having been received by the Secretary.

The Remuneration Committee of the Branch interviewed Mr. Fleming, Civil Service Commissioner, and Mr. Oxton, Deputy Minister of Public Works of the Provincial Government, and requested them to consider the adoption by order-in-council of the Schedule of Classification for Engineers which has been approved by the Manitoba Branch, and to apply it to the classification of all engineering employees in the Government's service. They also requested that when making up the estimates for the coming year, the new salary schedule approved by the Branch be considered and that the salaries of engineers in the Government's employ be re-adjusted to comply with this schedule. While no definite promise could be obtained from these gentlemen, the general feeling appeared to be sympathetic to the consideration of the Committee's request and it is hoped that before long the classification schedule will be adopted and enforced by the Provincial Government, and that the salaries of engineers in their employ will be adjusted to comply more nearly with the salary schedule of the Branch than at present is the case.

Taber Irrigation—Southern Alberta

A. S. Dawson, M.E.I.C.

The Taber Irrigation District, consisting of 17,000 acres of irrigable land in Tps. 9 and 10, Rges. 15, 16, 17, and 18, W. of the 4th. lying between Lethbridge and Medicine Hat, was placed under construction on July 24th, 1919, and completed on November 1st, 1920. The construction was carried out by the Department of Natural Resources of the Canadian Pacific Railway Company, under the terms of an agreement between the District, and the Company; the said lands being bonded to the amount of $272,000. to cover the cost of the work. The bonds were held in trust until the final completion, and delivery of the system to the District. The Company agrees to supply the district with 34,000 acre ft. of water annually, delivered at the headgates of the Taber Canal, at a gross annual charge of $8475.00, or 50 cents an acre. The works will be operated and maintained by the District, without further cost to the Company.

The District was erected pursuant to the provisions of the Irrigation District Act, 1915, on the 23rd day of August 1917.

The first surveys were started in 1915, and included about 7000 irrigable acres of School lands, in the Chin District, with ownership vested in the Crown; but as such lands could not be mortgaged, a new survey was made to the East of Taber, and new boundaries established. The final survey was made in the Fall of 1917.

Water for the project is stored in two reservoirs, known as Chin Coulee Reservoir in Tps. 8 and 9, Rgs. 17 and 18, which have a combined capacity of 43,000 ac. ft. at full supply. These basins are formed by two earth dams constructed across the coulee. The water is carried to them through the existing canals of the Company's Lethbridge Project, having been diverted from the St. Mary River, at Kimball — near the international boundary.

The system was designed with a legal duty of 2 ac. ft. delivered to the land. Main and secondary canals with a capacity of 1 sec. ft. for each 120 acres of irrigable land, plus 25% for losses. Distributaries, larger than 15 sec. ft. up to 50 sec. ft. gross capacity, 1 sec. ft. for each 100 acres, plus 25% for losses. Small distributaries, less than 15 sec. ft., 3 sec. ft. serving 1 unit of 80 acres or less, plus 1 sec. ft. for each additional unit of 80 acres or less, or 2 sec. ft. for each unit larger than 80 acres or less than 160 acres, up to a gross capacity of 15 sec. ft.

The main canal has a capacity of 170 sec. ft. at the upper end, and its total length is 23 miles. The distributaries have a total length of 54 miles.

The structures are principally of timber construction. Concrete was adopted for the headworks, the railway culverts, flume portals, and rating section. The headworks comprise two separate structures of similar construction — each with 2 openings 6 ft. wide, and radial gates operated by hand winches, built in an earth dam formed across the coulee. Culverts of the rail top type were built at railway crossings. A metal flume, 1500 ft. long, 8′ 4½″ diameter, with a maximum height of 21 ft. supported on frame bents and piles, carries the main canal across a depression near Barnwell. The fall from the sill of the headgates to the end of the main ditch is 81 ft., and 27 ft. of this is lost in a distance of 1½ miles in which 9–3′ drops are constructed. The country has a gradual fall to the East, and drains to the Old Man river on the north.

Ditch excavation was accomplished with fresnos and elevating graders. Very little hard material was encountered, and no solid rock. Progress was impeded by the early freeze up in the Fall of 1919, and serious labour shortage in 1920.

Very strong winds in the spring of 1920, caused soil drifting to such an extent that many of the ditches and structures constructed the previous year, were filled, and approximately 36,000 cu. yards of such material had to be moved twice.

The whole of the work was done under contract. The quantities were as follows:—

Earth work	380,000 cu. yds.
Timber in structures	600,000 F.B.M.
Concrete	225 cu. yds.

etc., etc.

The work as a whole was supervised by G. P. F. Boese, A.M.E.I.C., assistant engineer, and the system was designed in the office of A. S. Dawson, chief engineer of the Natural Resources Department of the Canadian Pacific Railway, with headquarters, at Calgary, Alberta.

Vancouver Branch

J. N. Anderson, A.M.E.I.C., Secretary-Treasurer.

Under the auspices of the Vancouver Branch, Major G. A. Walkem, M.E.I.C., delivered a lecture "With the Royal Engineer Railway Troops in Palestine" before the British Columbia Technical Association in the Board of Trade Auditorium on Monday 22nd. November. The lecture was illustrated by lantern slides.

The campaign was reviewed briefly by the lecturer, who gave a description of the operations, referring more particularly to the building of the light and heavy gauge railways during the campaign. He traced the work from the unloading of the railway material at the ship's slings at salt water to the final completion of the railway at Haifa. Details of the construction of the railway were gone into, and the slides also showed the character of the country, the habits of the natives, and the methods used by them in planting, gleaning and threshing their crops throughout Syria.

The lecture, besides being technical, was descriptive of the Country between Suez and Jerusalem.

A number of ladies and gentlemen were present as visitors to the Association and the lecture was thoroughly enjoyed.

At a meeting of the Branch held on December 21st, the officers of the Branch for 1921 were elected: Chairman, Major G. A. Walkem, M.E.I.C.; Vice-Chairman, C. Brakenridge, M.E.I.C.; Secretary-Treasurer, J. N. Anderson, A.M.E.I.C.; Executive Committee: A. E. Foreman, M.E.I.C., Major W. G. Swan, A.M.E.I.C., T. Muirhead, A.M.E.I.C., W. R. Bonnycastle, M.E.IC., P. Philip, A.M.E.I.C., A. C. Eddy, A.M.E.I.C.

At a meeting of the Council of the Association of Professional Engineers of British Columbia, held on Wednesday evening at the offices of the Association, 502-503 Yorkshire building, the election of the council of the Association for 1921 was formally concluded.

The election was by mail ballot as provided for in the constitution and by-laws of the association. The ballotting has been in progress for over a month, as the members of the association are widely scattered all over the province. The retiring council acted as scrutineers at the counting of the ballots, and declared the result as follows:—

President—D. O. Lewis, M.E.I.C., civil engineer, Victoria.

Vice-president—W. G. Swan, M.E.I.C., civil engineer, Vancouver.

Executive Council—Messrs. W. Anderson, M.E.I.C., civil engineer, Vancouver; J. M. Turnbull, mining engineer, Vancouver; Norman Yarrow, A.M.E.I.C., mechanical engineer, Victoria; J. A. M. Dawson, chemical engineer, Vancouver; J. Muirhead, M.E.I.C., electrical engineer, Vancouver.

Mr. Lewis was elected by acclamation to the Presidency, Mr. Fowler having withdrawn his name. Mr. Fowler's reasons for so doing were, that he had good information that certain powerful interests propose, at the forthcoming session of the B. C. Legislature, to endeavour to have certain amendments enacted (eliminating the compulsory clauses of the Engineering Profession Act,) and that in Mr. Fowler's opinion, the best interests of the engineering profession would be served by having a President residing on the Coast.

Under the regulations of the Engineering Profession Act, the Lieutenant-Governor-in-Council appoints an additional four members to the council of the association. These appointments have not yet been made owing mainly to the recent illness and death of late Col. E. G. Prior, Lieutenant-Governor of B. C.

The members of the association are to be congratulated on the very strong council they have elected, and also on the very fair distribution of the representation of the different branches of the engineering profession in the new council.

Victoria Branch

H. M. Bigwood, A.M.E.I.C., Secretary-Treasurer.

About thirty members of the Victoria Branch of *The Engineering Institute of Canada* met together for lunch at the Dominion Hotel, at noon on December 2nd. At the close of the repast, Col. A. W. R. Wilby, A.M.E.I.C., the Chairman of the Branch, spoke for a few minutes, confining his remarks to a few facts tending to indicate that too small a proportion of the members took an active interest in the local unit of the Institute. Messrs. N. A. Yarrow, A.M.E.I.C., E. G. Marriott, A.M.E.I.C., D. O. Lewis, M.E.I.C., and the secretary, H. M. Bigwood, A.M.E.I.C., also added a few words.

Preliminary Notice

of Applications for Admission and for Transfer

20th December, 1920

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in January, 1921

FRASER S. KEITH, Secretary.

The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

AEBERLI—J. ADOLF, of Toronto, Ont. Born at Zuerich, Switzerland, July 25th, 1877; Educ., M.E. (diploma), Winterthur-Zuerich, 1900; 1902-04, designing engr., Ruston Co., Prague, Bohemia; 1904-06, chief dftsman., Allis-Chalmers Co., New York, Scranton, Milwaukee; 1906-18, chief hydrometric engr., for same company in Montreal and Toronto; 1918 to date, engr. in charge of test and repair, hydro. equipment, H.E.P.C. of Ontario.

References: H. G. Acres, T. H. Hogg, M. V. Sauer, W. A. Bucke, R. S. Kelsch, T. F. Kaelin, C. V. Corless, J. Milne.

ALLWOOD—FRANK HAROLD, of Victoria, B.C. Born at Spanish Town, Jamaica B.W.I., July 1st, 1889; Educ., 2 yrs. McGill Univ., 1907-09; B.C.L.S. 1920; Reg'd Prof. Engr., of the Prov. of B C.; Transitman C.P.R.; Chief asst., G. H. Blanchett, D.L.S.; ch. asst., city engr., Revelstoke, B.C.; 1912-14, city engr., Revelstoke, B.C.; 1914-19, overseas, 1916-18, officer in charge of wireless telephony, R.A.F.; 1920 to date, asst. engr. on design & constrn. of Johnson St. Bridge, City of Victoria, B.C.

References: F. M. Preston, H. A. Icke, A. O'Meara, E. N. Horsey, F. W. Knewstubb.

ASHCROFT—CYRIL CROPTON, of York Mills, Ont. Born at Toronto, Ont., July 31st, 1897; Educ., At present 3rd year student Applied Science, Univ. of Toronto; 1913-15, land surveyor's asst., Speight & Van Nostrand; 1915-19, overseas, Lieut., C.F.A.

References: H. E. T. Haultain, P. Gillespie, J. R. Cockburn, T. R. Loudon, C. R. Young.

BAXTER—JOHN, of Montreal, Que. Born at Finderlie, Kinross Shire, Scotland, Dec. 19th, 1890; Educ., Science Course, Dollar Academy, Scotland, 1903-07, Lauder Technical College School (ele. engr'g & bldg. constrn.), 1907-10; 1907-12, pupil with the late T. Hyslop Ure, Architect & Civil Engr.; 1912, with Ross & MacDonald, Architects, Montreal, and rodman, C.P.R.; 1912-14, dftsman with P. J. Turner; 1914 (Mar.-Sept.), bldg. supt., Reid MacGregor & Reid, Gen'l Contractors, Montreal; 1914-19, overseas, Lieut. C.E.F.; 1919 to date, dftsman on constrn., J. M. Robertson Ltd., Consltg. Engrs., Montreal.

References: J. M. Robertson, W. I. Bishop, J. T. Farmer, J. M. Begg, LeR. Wilson F. S. Kuhns.

BLACKETT—VICTOR ST. CLAIR, of Moncton, N B. Born at Glace Bay, N.S., June 1st, 1886; Educ., B.Sc. (Mech.), McGill Univ., 1910; 1 yr. dftsman, Dominion Coal Co.; 1 yr. dftsman, Halifax Ocean Terminals; 3 yrs. mech. design, Dominion Coal Co.; 5½ yrs. with Halifax Ocean Terminals as follows: 2 yrs. ch. insp'r concrete block yard, 2 yrs. ch. insp'r., dredging operations, 1 yr. field engr., 6 mos. supt., pouring of concrete of foundations, Pier A; At present on harbour improvements, St. John.

References: W. A. Duff, M. J. Murphy, F. B. Fripp, H. Donkin, I. P. MacNab, J. S. Whyte.

BRANDEIS—CHARLES, of Montreal, Que. Born at London, England, Aug. 18th, 1874; Educ., Associate City & Guilds of London Institute, 1895, formerly A.M.E.I.C. (1903-19); 1903 to date, consulting engineer, Montreal.

References: F. H. Pitcher, D. S. Barton, A. F. Byers, F. C. Laberge, C. M. Morssen, F. T. Peacock, P. W. St. George, J. C. Smith, R. S. Lea, E. S. Mattice, T. W. Lesage.

BRANDER—FRANCIS WILLOUGHBY, of Ottawa, Ont. Born at Anerley, Surrey, England, June 10th, 1882; Educ., South Eastern College, Ramsgate, England; Professional Assoc. Surveyor's Inst. of England, 1905; 1900-03, articled pupil with A. E. Thompson, Architect and Surveyor, London, England; 1902-04, practical surveying and civil engr'g. under Richard Parry, F.C.S., London; 1904-06, asst. surveyor with various firms, London; 1906-09, asst. engr., Montreal Water & Power Co.; 1909-10, bldg. insp'r., Midland Rly., Buenos Aires, Argentine; 1910-11, asst. surveyor, C.P.R. Eastern Divn.; 1911-12, engr'g. dftsman., C.N.O. Rly. Ottawa; 1912-19, engr'g. dftsman., Dominion Water Power Branch, Ottawa; 1919 to date, general engr'g. clerk and dftsman., Natural Resources Intelligence Branch, Dept. of the Interior, Ottawa.

References: C. R. Coutlee, T. H. Dunn, H. E. M. Kensit, T. H. G. Clunn, W. C. Gillis, F. H. Kitto, P. Sherrin.

CAIN—EVERETT THOMAS, of Moncton, N.B. Born at Zepher, Ont., Nov. 3rd, 1882; Educ., B.A.Sc., Univ. of Toronto, 1913; 1909-10 (summers), on constrn. of bridges and concrete arch culverts, Ontario County; 1911-12 and 1913 (May-Nov.), struct'l dfting., Dominion Bridge Co., Lachine; 1913 to date, designing, detailing, etc., bridge dept., C.N.R., Moncton.

References: W. A. Duff, C. B. Brown, D. C. Tennant, P. Gillespie, C. R. Young, S. B. Wass, F. B. Fripp.

CHAPMAN—LEONARD RUSSELL, of Winnipeg, Man. Born at Battersea, Ont., Dec. 21st, 1880; Educ., High School; 1900-03, rodman, Algoma Central Ry.; 1903-11, topog'r., instr'man. and res. engr., G.T.P.Ry.; 1911-13, transitman and res. engr., Algoma Central Ry.; 1913-15, res. engr., Hudson Bay Ry.; 1915-19, overseas; 1920, res. engr., and at present transitman, C.N.R.

References: E. K. Hall, J. V. Dillabough, L. E. Silcox, J. L. Charles, R. W. Jones, C. K. Brown.

COLLIS—WILLIE ORME, of Chapleau, Ont. Born at Henfield, England, April 19th, 1882; Educ., Intermediate B.Sc., London Univ., 1911. I.C.S. (railroad engr'g); 1912-14, rodman, leveller and transitman, C.P.R.; 1914-19, overseas, Royal Engrs.; 1919 to Sept. 1920, senior transitman, C.P.R., and at present in charge of location and constrn. party under divn. engr.

References: J. R. Caswell, T. B. Ballantyne, W. O. Cudworth, S. B. McConnell, J. M. R. Fairbairn.

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*The professional requirement are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option Railway, Municipal, Hydraulic, Mechanical, Mining, or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-five years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits scientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

COON—HAROLD FRANKLIN, of Toronto, Ont. Born at Hamilton, Ont., April 27th, 1896; Educ., B.A.Sc., Univ. of Toronto, 1920, Surveying for Toronto Harbor Commission, McKay, McKay & Ferrie, Civil Engrs. and Surveyors, Hamilton Roads Dept., Barrett Mfg. Co., Toronto; At present, road engr'g., Barrett Mfg. Co. Ltd., Toronto.

References: A. E. Jupp, E. A. James, P. Gillespie, C. R. Young, T. R. Loudon.

CROMBIE—HUGH ARTHUR, of Montreal, Que. Born at Saginaw, Mich., U.S.A., Sept. 23rd, 1896; Educ., B.Sc., McGill Univ. 1918, Summers '12-'13-'14, with C.P.R. on field work; 1915, mech. dept., C.N.R.; 1916-18, Lieut., Can. Engrs.; 1918-20, mech. dept., C.N.R., Toronto; At present in Engr's Office, Paper Mach. Dept., Dominion Engr'g Works, Lachine.

References: G. E. Bell, C. M. McKergow, W. G. Swan, E. Brown, F. I. Ker, H. M. MacKay.

CRYSLER—ROY ALAN, of Toronto, Ont. Born at Toronto, May 1st, 1896; Educ., B.A.Sc., Univ. of Toronto, 1920; 1912-13, dftsman, Smith Kerry & Chace, Toronto; 1914 (summer), instr'man., Speight & Van Nostrand, Toronto; 1915 (summer), instr'man., James Loudon & Hertsberg, Toronto; 1916-19, overseas, with Engrs., and 2nd Lieut., R.A.F.; 1919 (Apr.-Oct.), res. engr. at Orillia for E. A. James & Co.; 1920 (May-June), ass't. engr., Prov. Board of Health of Ontario; 1920 (July-Sept.), engr. & surveyor to Town Planning Commission, Niagara Falls, Ont.; Oct. 1920 to date, with H.E.P.C. of Ontario.

References: E. A. James, T. R. Loudon, P. Gillespie, A. C. D. Blanchard, D. T. Black, F. W. Clark.

CURRIE—HOMER LINDSAY, of Moncton, N.B. Born at Woodstock, N.B., Jan. 30th, 1892; Educ., B.Sc. (C.E.), Univ. of N.B., 1913; 1913-16, leveller and dftsman. on location C.N.R.; 1916-19, overseas; 1919-20, instr'man on constrn. C.N.R.; At present in district engr's office, C.N.R., Moncton.

References: C. B. Brown, S. B. Wass, M. Burpee, F. W. Alexander, J. S. O'Dwyer, W. A. Duff.

DAVIS—CECIL REGINALD, of Welland, Ont. Born at Cayuga, Ont., July 8th, 1899; Educ., At present 1st year mech. engr'g., Univ. of Toronto; Corres. course in motor engr'g., Bennet College, Sheffield, England, 1917-19; 6 yrs. experience in operating and repairing automobiles and marine gas engines etc.; 1916-18, operating motor vehicles, C.E.F.

References: P. Gillespie, C. R. Young, H. T. Hazen, H. K. Wickstead, J. H. Hooper.

DENLEY—WILLIAM EDWARD, of Regina, Sask. Born at Cornhill, Scotland, April 2nd, 1887; Educ., Huddersfield College, England; 1907, rodman, C.P.R.; 1908-10, rodman and instr'man., C.N.R.; 1911-13, engr. for D. F. McArthur on constrn. 'Bigcut', So. Alberta Land Co's Irrigation Ditch; 1913-15, asst. supt. on constrn., Edmonton Branch, National Constrn. Co. Ltd.; 1915-19, overseas, Lieut., Can. Engrs.; At present asst. engr., Highways Dept., Regina, for Sask. Govt.

References: H. S. Carpenter, C. W. Dill, M. B. Weeks, H. R. MacKenzie, H. B. Stuart.

DESMARAIS—RAYMOND JOSEPH, of Walkerville, Ont. Born at Walkerville, Nov. 8th, 1894; Educ., 1 year Univ. of Detroit; 1909-19, with Owen McKay, Walkerville, as rodman and instr'man on surveys, drainage, etc.; 1919 (Sept.-Dec.), with R. W. Code, O.L.S. & C.E., Windsor, Ont., in charge of surveys, pavements, etc.; Jan. 1920 to date, asst. engr., under M. E. Brian, City Engr., Windsor, Ont.

References: M. E. Brian, J. J. Newman, C. R. McColl, W. J. Fletcher, H. B. R. Craig.

DISNEY—CHARLES P., of Toronto, Ont. Born at Montreal, Que., June 11th, 1885; Educ., special engr'g lectures Boston Technical & C. Thompson's Engr'g Classes, Dominion Bridge Co.; 5 yrs. struct'l. detailing etc., N.T.C. Rly., Ottawa; 9 yrs. gen'l. designing, estimating etc., N.T.C. Rly., Ottawa; 4½ yrs. Capt., Royal Engrs., in charge of bridge design, constrn., etc.; 1919 to date, engr. of bridges, Eastern Lines, C.N.R., Toronto.

References: R. K. Palmer, A. F. Stewart, H. P. Borden, C. N. Monsarrat.

DURANT—SELWYN ELD, of Dalroy, Alta. Born at Maidstone, Kent, England, Feb. 13th, 1881; Educ., National Diploma of Agriculture, Univ. of London, 1900; 1901-04, Junior asst., Abenkir Co. Ltd., on the reclamation of Lake Abenkir, Egypt. During last year in complete charge; 1904-10, with Sudan Govt., as inspector of Agriculture & lands; 1911, in charge agricultural work of B.C. Development Co.; 1912 to date, Irrigation Branch C.P.R., and at present asst. canal supt., D.N.R., C.P.R.

References: F. H. Peters, A. S. Dawson, R. S. Stockton, G. H. Patrick, E. N. Ridley, W. G. Bligh.

DUSCHAK—ERNEST A., of Regina, Sask. Born at Buffalo, N.Y., U.S.A., June 24th, 1883; Educ., Civil Engr., Cornell Univ., 1906; 1905 (summer), rodman on city surveys, Buffalo, N.Y.; 1906 (June-Sept.), rodman, New York Central & Hudson River R.R.; 1906-07, instr'man., Columbus, Ohio, Water Purification Plant; 1907-08, in charge final estimate $3,000,000 contract, Pittsburgh, Pa., filtration plant; 1908-09, jr. engr., United States Engrs., Buffalo, in charge of dredging & breakwater constrn.; 1909-12, asst. on New York State Barge Canal at Senecal, N.Y.; 1912-16, not engaged in engr'g work; 1916-17, engr. in charge of constrn. of struct'l steel mill bldgs., concrete bldgs., etc.; 1917-1920, designing engr., Imperial Oil Co. Ltd., Sarnia; July 1920 to date, mech. supt., at Regina refinery for above company.

References: C. D. Dean, E. M. Salter, R. C. McCully, J. N. deStein.

EDMANDS—ALFRED, of Moose Jaw, Sask. Born at Derby, England, May 17th, 1878; Served 6½ years with James Wright, Architect & Surveyor, Derby, England, after which practised privately as architect in Derby; 1910-13, dftsman, C.P.R.; 1913 to date, chief dftsman., C.P.R. Sask. Dist.

References: J. R. C. Macredie, C. D. MacKintosh, T. C. Macnabb, C. S. Moss, F. Lee, J. C. Holden.

ELLIS—WALTER HARVEY, of Kingston, Ont. Born at Cobourg, Ont., Sept. 27th, 1891, Educ., B.A., Queen's Univ., 1914. At present 4th year student Civil Engr'g., Queen's Univ., Summer work, Can. Locomotive Works, Kingston shipyards, International Waterways Surveys, 2 yrs. asst. on paving contracts reinforced concrete & brick; 1 yr. asst. on reinforced concrete bldg. constrn., 4 yrs. overseas, 2 yrs. Can. Engrs., and 2 yrs. Can. Seige Artillery

References: A. Macphail, W. P. Wilgar, W. L. Malcolm, D. S. Ellis

ERICSON—CHARLES GOTTHARD, of Toronto, Ont. Born at Joliet, Ill., U.S.A., Nov. 4th, 1875; Educ., L.L.B., Univ. of Valparaiso, 1904; 1893-1900, with Illinois Steel Co., Joliet, Ill.; 1900-04 (exception of college terms), with above company as asst. foreman, foreman, asst. supt. and on inspecting engr's staff; 1904-09, ch. inspector, Toronto and Hamilton districts for Robert W. Hunt Co. Ltd., Inspecting and Consltg. Engrs.; 1909-11, ch. inspector of steel etc., H.E.P.C. of Ontario; 1912 to date, with Robert W. Hunt Co. Ltd., gen. mgr., Montreal office, and since 1915, mgr. Toronto office.

References: H. G. Acres, R. L. Latham, A. F. Stewart, E. G. Hewson, T. U. Fairlie, G. A. McCarthy.

EWART—FRANK RICHARD, of Toronto, Ont. Born at Toronto, March 12th, 1887; Educ., B.A.Sc., Univ. of Toronto, 1908; 1906 (summer), asst. to engr., pulp mill constrn., Clarke City, Que.; 1907 (summer), ap'ticeship course, Westinghouse Co., Pittsburg; 1908-09, demonstrator in elec. engr'g., Faculty of Applied Science, Univ. of Toronto; 1909-11, asst. engr., Smith, Kerry & Chace; 1911-13, power sales engr. and contract agent, H.E.P.C., Toronto; 1913 to date, member of firm, Ewart, Jacob, Armer & Byam, Ltd., Consltg. Engrs., Toronto.

References: A. H. Harkness, A. L. Mudge, J. B. Challies, E. T. J. Brandon, W. A. Bucke, W. Chipman, H. G. Acres, F. M. Byam.

FISK—HOMER ORRIN, of Peterboro, Ont. Born at Abbotsford, Que., Feb. 14th, 1866; 4 yrs. shop course, Royal Electric Co.; 1890-1894, supt. & E.E., Peterboro Light & Power Co. & Radial Rly. Co.; 1911, supt. of power for Peterboro district for Electric Power Co.; 1914 to date, mgr., Peterboro Utilities Commission.

References: R. B. Rogers, R. H. Parsons, R. L. Dobbin, P. P. Westbye, C. E. Sisson.

FOWNES—FRED JOHN, of Moncton, N.B. Born at Elgin, N.B., Nov. 9th, 1893; Educ., I.C.S.; 1911-13, rodman, C.G.R.; 1913-15, dftsman & transitman; 1915-19, overseas; 1919 to date, transitman, C.N.R., Moncton.

References: E. G. Evans, J. S. O'Dwyer, R. H. Emmerson, M. J. Murphy, W. A. Duff, S. B. Wass.

FULLER—ROYDEN JOHN, of Toronto, Ont. Born at Alliston, Ont., Jan. 26th, 1882; Educ., B.A.Sc., Univ. of Toronto, 1912; 1911 (summer), struct. dftsman., Dominion Bridge Co.; 1912 (May-Nov.), struct. dftsman. and checker, Canada Foundry Co.; 1912-17, in dept. of City Architect & Supt. of Bldg., City of Toronto; 1917 to date, ch. engr., John V. Gray Constrn. Co. Ltd., Toronto.

References: A. H. Harkness, C. A. Meadows, J. B. Carswell, E. M. Proctor, T. R. Loudon, T. H. Hogg, C. R. Young, P. Gillespie, G. A. Colhoun.

GEROW—STANLEY, of Cleveland, Ohio, U.S.A. Born at Rossmore, Ont., April 23rd, 1890; Educ., B.Sc., Queen's Univ., 1914; 1910 (Apr.-Oct.), foreman on highway constrn.; 1913 and 1915 (summers), in charge of parties for F. M. Eagleson, O.L.S., D.L.S.; 1916-17, ch. insp'r. of munitions brass and cartridges for Russian Comm'n. at Detroit and Cleveland; 1917-18, production engr., The Toledo Bridge & Crane Co.; 1919 to 1920 asst. equipment engr., and at present supt. of bldgs., Willard Storage Battery Co., Cleveland, Ohio.

References: J. M. Oxley, A. Macphail, W. L. Malcolm, D. S. Ellis, J. B. Wilkinson, L. W. Gill, L. E. Allen.

GOODWIN—GEORGE, of Ottawa, Ont. Born at Ottawa, Aug. 30th, 1888; Educ., 2 yrs. Civil, 3 yrs. chemistry and mineralogy, Queen's Univ.; 1907-13, dfting and gen'l engr'g for Col. R. S. Low; 1914, surveying; 1915-19, overseas; 1919, charge of survey party and supt. of bldg. constrn; At present on hydrometric work, D.P.W., Ottawa.

References: C. R. Coutlee, S. B. Johnson, R. deB. Corriveau, A. DesRosiers, S. J. Chapleau.

GREENWOOD—WILLIAM, of Kingston, Ont. Born at Toronto, Ont., March 2nd, 1898; Educ., At present 3rd year student Applied Science, Queen's Univ.; 5 mos. Geol. Survey of Canada.

References: A. Macphail, W. P. Wilgar, W. L. Malcolm, D. S. Ellis, L. T. Rutledge.

HERMANN—THOR, of Calgary, Alta. Born at Husavik, Iceland, Sept. 19th, 1884; Educ., Civil Engineer, North Dakota Univ., 1910; 2 yrs. steel design, 2 yrs. dfting, Dominion Bridge Co., Winnipeg; 1 yr. supt., The Northern Constrn. Co., Grand Forks, N.D.; 1½ yrs., City Engr., Vegreville, Alta.; At present, hydrometric engr., Irrigation Branch, Dept. of the Interior, Calgary, Alta.

References: A. L. Ford, G. H. Whyte, F. K. Beach, P. M. Sauder, G. N. Houston.

HIGGINS—PETER MCLOUGHLIN, of Toronto, Ont. Born at Midleton, Ireland, July 27th, 1890, Educ., Bach. of Engr'g., National Univ. of Ireland, 1912; Surveying in Ireland during vacations; 1913-15, asst. to A. M. Jackson, O.L.S.; 1915-16, asst. engr., Baldry, Yerburgh & Hutchinson, Contractors, Section 2, Welland Ship Canal; 1916-19, overseas, 1 yr. Can. Corps Survey Section; 1919 to date, dftsman., rly. dept., H.E.P.C. of Ontario.

References: A. M. Jackson, G. F. Hanning, E. T. Agate, J. H. Congdon, F. B. Geodike, J. C. N. B. Krumm, A. L. McDougall.

HILLMAN—WILLIAM ANGUS, of Moose Jaw, Sask Born at Clachan P O, Ont., Feb. 16th, 1888; 1907-14, rodman, instr'man & res. engr, C.P.R. Eastern Lines; 1914 (2 mos.), instr'man., C.N.R.; 1914-15, instr'man., with Westinghouse, Church Kerr; 1915-17, res. engr., H.B.Rly.; 1918-19, res. & asst. engr., Winnipeg Aqueduct constrn.; At present layout engr & Chief officeman for Carter-Halls Aldinger Co., on new C.P.R. Station, Moose Jaw.

References: J. R. C. Macredie, C. S. Mosa, T. E. Silcox, G. F. Richan, J. V. Dillabough.

HOGG—JAMES OLIVER, Jr., of Kansas City, Mo., U.S.A. Born at Kansas City, June 12th, 1889; Educ., Special course in Architecture, Univ. of Illinois. I.C.S. & A.C.S. (civil engr'g.); 1913 (Sept.-Dec.), supt. of constrn. on reinforced concrete warehouse for John W. McKechnie; 1914 (Jan.-Apr.), res. engr., Kansas City Terminal Ry Co.; 1914-16, supt. of constrn. for the School Board of Kansas City; 1917, dftsman., Horton Constrn. Co., Kansas City; 1917-18, supt. of constrn., Gray Constrn. Co., Kansas City; 1918-19, asst. to res. engr., Waddell & Son, Consltg. Engrs. on 4th St. viaduct, Kansas City; 1919 to date, estimator & Constrn. engr., Collin Bros. Constrn Co., Kansas City.

References: J. A. L. Waddell, N. E. Waddell, W. S. Bellows, J. L. Harrington, I. G. Hedrick, E. O. Fuce.

HOLDEN—OTTO, of Toronto, Ont. Born at Toronto, Oct. 30th, 1891; Educ., B.A.Sc. (Honours), Univ. of Toronto, 1913; 1910-11-12 (summers), dftsman., C.H. & P.N. Mitchell, Toronto Street Rly., rly. constrn., C.P.R.; 1913 (5 mos.), transitman, Toronto Street Rly.; 1913-18, designing dftsman., hydraulic dept., H.E.P.C.; 1918 to date, asst. to M. V. Sauer, on hydraulic design, H E.P.C.

References: T. H. Hogg, M. V. Sauer, H. G. Acres, C. H. Mitchell, A. C. D. Blanchard, J. J. Traill, F. A. Gaby.

JACKSON—JOHN EDWIN, of Hamilton, Ont. Born at East Oxford, Ont., Dec. 27th, 1881; Educ., Grad. S.P.S, 1909. O.L.S., D.L.S., 1911; 1909 (8 mos.), in charge constrn. narrow gauge rly. etc., Crown Gypsum Co., Buffalo, N.Y.; 1910-11, with W. H. Fairchild, O.L.S., Brantford, Ont.; 1912-15, with J. W. Tyrrell & Co., Hamilton, Ont., chiefly as partner and mgr; 1916-19, in charge of D.L.S. party in Northern Man. and Sask.; At present with MacKay, MacKay & Perrie, Hamilton.

References: J W Tyrrell, F W Paulin, W. B. Ford, A. M. Jackson. E. R. Gray, E. H. Darling.

JANES—PERCY OSCAR GORDON, of Toronto, Ont. Born at Bury, England, Jan. 31st, 1885; Educ., 6 year course at Manchester School of Technology; 1899-1906, ap'ticeship to mech. engr'g., and studying at Bury & Salford Technical Inst.; 1906-09, dftsman. and engr., Galloways, Ltd., Manchester; 1909-11, ch. dftsman., Daniel Adamson & Co.; 1911-13, dftsman. and mech. engr., T. Pringle & Son, Ltd., Montreal; 1912-16, engr. and specialist, Canadian Fairbanks-Morse Co. Ltd. of Canada; 1916 to date, vice-pres, gen. mgr. and ch. engr., Canadian SKF Co. Ltd., Toronto and Montreal.

References: J. S. Costigan, E. A. Jacobson, I. H. Nevitt, C. B. Hamilton, Jr., W. Chipman.

JOB—FRANK HAMILTON, of Hamilton, Ont. Born at Hamilton, Nov. 26th, 1892; Educ., Junior matric. 1908. Hamilton Collegiate Inst. Cert. for struct'l design 1919. A.S.C. course in struct'l engr'g.; 1909-11, production clerk, Pittsburg Steel Co., Hamilton; 1911 to date, with Hamilton Bridge Co., as tracer, detailer, and at present struct'l dftsman.

References: J. A. McFarlane, R. K. Palmer, J. G. Jack, C. H. Marrs, J. G. Campbell, G. A. Colhoun.

JOB—STANLEY ROBERT, of Welland, Ont. Born at Hamilton, Ont., Aug. 14th, 1890; Educ., Hamilton Technical School. I.C.S. (bridge engr'g.) and private study; 1906-11 and Jan.-Mar. 1912, dftsman., Hamilton Bridge Works Co.; 1912 (Mar.-Sept.), Dominion Bridge Co., Toronto; 1914, Hamilton Steel Constrn. Co.; 1918 (Mar.-Dec.), with Herbert Morris Crane & Hoist Co., on design of hand power cranes etc.; 1918-20, with American Cyanamid Co., on design and detail of struct'l steelwork, etc.; March 1920 to date, designing dftsman., H.E.P.C. of Ontario.

References: S. R. Frost, R. K. Palmer, G. A. Colhoun, D. A. Williamson, E. H. Darling, R. P. Johnson.

LAURIE—ALBERT, of Montreal, Que. Born at Montreal, June 2nd, 1877; Educ, B.A.Sc, McGill Univ., 1898; 1898-1900, asst. supt., Laurie Engine Co.; 1900-03, supt, same firm; 1903-05, Pittsburg Engr'g Dept., Westinghouse Electric Co.; 1905-07, supt., Stratford Mill Building Co., Stratford, Ont.; 1907 to date, member of firm, Laurie & Lamb, Montreal.

References: J. H. Hunter, S. F. Rutherford, G. R. MacLeod, J. T. Farmer, F. A. Combe, C. M. McKergow.

LEAMON—CHARLES EDWARD, of Montreal, Que. Born at Launceston, England, Jan. 2nd, 1885; Educ., 6 yrs. as asst. master in private schools in England; 1912, on Dom.Land Survey; 1913-14, rodman and dftsman on constrn, Lake Superior Divn., C.P.R.; 1915, with Greater Winnipeg Water District; 1916-19, overseas, Royal engrs., in charge of various survey parties in Palestine; At present, dftsman. Dept. of Rlys. and Canals, Grand Trunk Arbitration.

References: V. I. Smart, D. Hillman, J. A. Boyle, H. H. Pinch, J. H. Edgar, W. C. MacDonald.

LILLICO—ROBERT SEWELL BRUCE, of Calgary, Alta. Born at Ayr, Ont., May 17th, 1886; Educ., B.Sc., Univ of Alberta, 1920; 1909-12, rodman, instr'man., res. engr., G.T.P.; 1914-20, univ. of Alberta and 2½ years overseas; June 1920 to date, asst. hydraulic engr., Dept. of the Interior, Calgary.

References: F. H. Peters, A. L. Ford, R. S. L. Wilson, B. Russell, Jr., M. H. Marahall.

LOW—CHARLES MACRITCHIE, of Toronto, Ont. Born at Edinburgh, Scotland, Sept. 27th, 1888; Educ., B.Sc. (Engr'g.), Edinburgh University, 1911; Assoc. Mem. Inst. C.E., 1914; 1906-10, pupil with Thomas Mink & Son, Edinburgh; 1911-12, rodman, C.N.R.; 1912-14, res. engr., C.N.R.; 1914 (July-Dec.), engr. for Hodge Constrn. Co.; 1915-19, overseas, Can. Engrs. (comm'd 1918); 1919 to date, dftsman., rly. dept., H.E.P.C. of Ontario.

References: A. F. Stewart, T. U. Fairlie, H. Wykes, J. C. Krumm, A. H. Greenlees.

MacKAY—ERNEST GEORGE, of Hamilton, Ont. Born at Braemar, County of Oxford, Aug. 4th, 1888; Educ., Grad. S.P.S., 1910. B.A.Sc., Univ. of Toronto, 1912, O.L.S., D.L.S.; 1908 (summer), with J. W. Tyrrell, D.L.S.; 1909 (summer) and 1910-11, transitman in charge of party, J. W. Tyrrell, D.L.S., Manitoba; 1911 (summer), in charge of party, Phillips Stewart & Lee, Surveyors Saskatoon; 1912-14, member of firm, MacKay, MacKay & Webster, Hamilton; 1914-19, overseas; 1919 to date, member of firm, MacKay, MacKay & Perrie, Hamilton.

References: C. H. Mitchell, J. W. Tyrrell, W. B. Ford, R. K. Palmer, E. H. Darling, F. W. Paulin, A. M. Jackson.

MacKAY—JAMES J., of Hamilton, Ont. Born at Woodstock ,Ont., Feb. 26th, 1876; Educ., 3 yrs. School of Science, Univ. of Toronto, 1899-1902. O.L.S., 1808; 3 yrs. with city engr., Woodstock, Ont.; 1902, took charge of gen'l practice of J.W Tyrrell & Co., Gen'l City Surveying, and in 1901 became partner in firm and continued so until 1911; 1912, senior member of firm, MacKay, MacKay & Webster, (carried on alone during war, partners overseas). In 1918 Mr. Webster withdrew from firm and Mr. Perrie taken in as partner; 1911, organized MacKay Paulin Constrn. Co., later re-organized as The Canadian Engineering & Contracting Co.; At present president of above company and senior member of firm MacKay, MacKay & Perrie, Hamilton, Ont.

References: J. W. Tyrrell, F. W. Paulin, E. H. Darling, R. K. Palmer, C. H. Marrs, E. L. Cousins.

MacLAREN—JAMES FERRIS, of Toronto, Ont. Born at Ingersoll, Ont., March 8th, 1892; Educ., Technical High School and correspondence courses in math., dfting. and civil engr'g.; 1911 (July-Nov.), instr'man., irrigation survey, So. Alberta Land & Irrigation Co.; 1912 (Apr.-Oct.), dftsman & instr'man., power house erection, Quebec City; 1912-13, dftsman., Hazel & Whipple, Toronto office; 1913-14, asst. engr., water supply section, Dept. of Works, Toronto; 1914-15, supt. of constrn., new pumping station, Toronto Water Works; 1916-19, overseas; 1919 to date, asst. engr. on water works design and constrn., Dept. of Works, Toronto.

References: G. G. Powell, J. Milne, C. L. Fellowes, W.R.Worthington, I. H. Nevitt.

MacROSTIE—NORMAN BARRY, of Ottawa, Ont. Born at Metcalfe, Ont., Jan. 14th, 1885; Educ., B.Sc. (Civil), 1911, B.A., 1912, Queen's Univ., D.L.S. 1913, O.L.S. 1914; 1909 (summer), rodman, city engr's. office, Ottawa; 1910 (summer), ass't. on location survey, Morrisburg & Ottawa Electric Rly.; 1911 (May-Nov.), asst. to P. R. A. Belanger, D.L.S., in charge of field work; 1913 (Mar. and Apr.), with J. B. McRae, consltg. Engr, Ottawa; 1913-16, asst. roadway engr, engr. in charge of special work and city surveyor, City of Ottawa; 1916-18, gauge examiner, under Capt. R. J. Durley; 1918-19, Lieut. Can. Engrs.; 1919 to date, member of firm Lewis & MacRostie, Civil Engrs. and Surveyors, Ottawa.

References: F. B. Brown, J. B. McRae, A. F. Macallum, A. Macphail, W. F. M. Bryce, F. C. Askwith, J. L. Busfield.

MARCK—JOHN ALPHONSE, of Hamilton, Ont. Born at Hamilton, Oct. 22nd, 1892; Educ., 3 yrs. Technical School, Hamilton; 1910-14, with J. J. MacKay, Civil Engr., Hamilton; 1915, city engrs. Office, Hamilton; 1916-17, landscape engr., Toronto; 1917-19, with Steel Co. of Canada, Hamilton; 1919-20, bridge constrn. etc., San Domingo; At present, civil engr., Steel Co. of Canada, Hamilton.

References: C. F. Whitton, E. R. Gray, F. W. Paulin, J. B. Nicholson, F. R. Adelhelm.

MARSHALL—SAMUEL ALLAN, of Hamilton, Ont. Born at Snelgrove, Ont., Sept. 5th, 1880; Educ., Grad. S.P.S., Univ. of Toronto, 1907; 1906 (4 mos.), mach. shop, round house, Bayne City, Mich.; 1907 (6 mos.), Hamilton Bridge Works Co., on assembling steel work, also 6 mos. in drawing office; 1909-19, drawing office, Dominion Bridge Co., Lachine, checking etc.; At present checker in drawing office, Hamilton Bridge Works Co., Hamilton.

References: R. K. Palmer, J. A. McFarlane, C. H. Marra, D. C. Tennant, A. Peden, Jr., F. P. Shearwood.

MARTIN—FRANK HENRY, of Winnipeg, Man. Born at Nanuet. N.Y., Dec. 2nd, 1881; Educ., Private study of math. and mech. engr.; 1898-1901. ap'ticeship with Dexter Folder Co., Pearl, N.Y.; 1901-03, dftsman., American Smelting & Refinery Co., Perth Amboy, N.J.; 1903-04, engr'g. dftsman., De La Mar Copper Works, Cartaret, N.J.; 1904-05, engr'g. dftsman., F. S. Pearson, Dr. Sc., New York; 1905 (Apr.-Nov.), asst. to ch. dftsman., Tennessee Copper Co., Copper Hill, Tenn.; 1905-06, in charge of tech. dept., Rio Janeiro Tramway, Light & Power Co., Brazil; 1906-09, ch. dftsman. Electric Development Co. of Ontario, Niagara Falls, Ont.; 1909 (Apr.-Sept.), in engr'g. office, F. S. Pearson, Dr. Sc., New York; 1909-10, engr'g. dept., Ontario Power Co., Niagara Falls, Ont.; 1910-12, asst. res. engr., Toronto Power Co., Niagara Falls, Ont.; 1912-14, supt. of above company; 1914-16, designing engr., Winnipeg River Power Co., Winnipeg; 1916-19, designing engr. and ch. engr., for Willis & Adams, Consltg. & Constructing Engrs., Niagara Falls, N.Y.; July 1917 organized the 'Martin Engr'g. Corpn.'; 1919 to date, designing engr., Winnipeg River Power Co., Winnipeg.

References: J. B. Challies, G. L. Guy, J. M. Leamy, W. M. Scott, R. S. Lea, F. A. Gaby, M. V. Sauer, H. G. Acres.

McCABE—MICHAEL ANDREW, of Moncton, N.B. Born at Newcastle, N.B., Aug. 9th, 1894; Educ., 1 yr. Arts, 1¾ yrs. engr'g., St. Francois Xavier College, Antigonish; 1½ yrs. rodman, C.N.R. (prior to enlistment); 1916-19, overseas; 1919, rodman, C.N.R.; 1920, Dftsman., bridge dept., C.N.R.

References: W. A. Duff, R. J. Anderson, J. Whitelaw, M. J. Murphy, S. B. Wass, J. G. Dryden.

McCREARY—JAMES WALLACE, of Montreal, Que. Born at Winnipeg, Man., May 10th, 1883; Educ., 2 yrs. Wesley College, Winnipeg; 3 seasons on D.L.S. & Int. Boundary; 1904, rodman on location & constrn. for Soo Line, Minnesota, U.S.A.; 1905-06, transitman on prelim. & location with N.T.C. Rly.; 1907-08, transitman, G.T.P., Prince Rupert, 1909, asst. engr., G.T.P. Townsite, Prince Rupert; 1910-12, transitman, locating and res. engr., C.N.R., B.C.; 1912-13, locating engr. on High River & H.R.Ry., Calgary, Alta.; 1914-18, overseas sgt. engr., Can. Rly. Troops; 1919 to June 1920, D.S.C.R.; At present asst. engr., Nova Scotia Highways, on special investigation work under D. Hillman.

References: C. L. Hervey, N. J. Ogilvie, W. G. Swan, N. B. MacTaggart, D. A. Livingston, E. LeR. Tait.

McGILLIVRAY—CHARLES ALLAN, of New Westminster, B.C. Born at Ottawa, Ont., Aug. 6th, 1888; Educ., B.Sc., Queen's Univ., 1910; one year on motor install'n., Geo. C. Hinton & Co., Vancouver; 9 mos. contracting on house wiring, New Westminster, B.C.; 6 mos. dftsman., C.P.R., Vancouver; 1912-13, observer, Alaska Boundry survey, Dom. Govt.; 1914-15, asst. elect'l. engr. & Supt. of install'n. and operation of elect'l. equipment at Halifax and Ft. Nelson for Dept. Rlys. & Canals, 1916-18, elec'l. engr., Shawinigan Water & Power Co.; 1919 (Apr.-Oct.) and 1920 (April-Oct.), observer, Geodetic Survey of Canada, Ottawa.

References: J. Murphy, D. W. McLachlan, N. J. Ogilvie, G. H. McCallum, A. Macphail, W. P. Wilgar, J. C. Smith

McGUINNESS—THOMAS, of Regina, Sask. Born at Wrexham, Wales, Dec. 21st, 1881; Educ., 1897-99, evening classes, Science & Arts School, Wrexham; 1897-98, bldg. ap'tice; Ap'tice. engr'g shops, Great Central Railway and Wrexham, Mold & Conway's Quay Railway, Wrexham; 1902-07, with R. W. Blackwell & Co., Elect'l Engrs., London, England, in charge of various works; 1907-12, electrolysis insp'r., City of Winnipeg, in charge of all return circuits & testing. Also completing a special survey for Prof. Herdt; 1914-16, gen'l foreman on constrn. & mtce. of trolley wires, etc., City of Regina Street Railway Dept.; 1916-19, overseas with C.R.T.; 1919 to date, asst. supt., City of Regina Street Railway Dept.

References: L. A. Thornton, L. A. Herdt, D. W. Houston, G. L. Guy, D. A. R. McCannel.

McINTEE—ARTHUR, of Toronto, Ont. Born at Glasgow, Scotland, Feb. 4th, 1882; Educ., Glasgow & West of Scotland Technical College; 1897-1908, ap'tice and asst. engr., Glasgow, Barrhead & Kilmarnock and Glasgow & Paisley Joint Rlys.; 1908 (Sept.-Oct.), cost clerk, Tompson & Reid, T.C.Ry.; 1908-14, rodman, dftsman, transitman & res. engr. on mtce. & constrn., C.P.R.; 1914-15, gen'l inspector & acting ch. engr., Glengarry & Stormont Rly., Ont.; 1916-19, overseas, Can. Engrs.; 1919 to date, field dftsman., H.E.P.C. of Ontario.

References: E. T. Agate, C. T. DeLamere, K. Weatherbe, C. W. P. Ramsey, C. L. Hervey.

McLEISH—ROBERT GRAHAM HAMILTON, of St. Catharines, Ont. Born at Glasgow, Scotland, Aug. 8th, 1898; Educ., 2 yrs. Khaki College (overseas), 6 mos. vocational course, Queen's Univ.; 2 yrs. jr. dftsman., C.G.E.Co., Peterboro; At present dftsman., H.E.P.C. of Ontario.

References: J. A. G. Goulet, E. M. Wynn, L.L.Gisborne, J. M. Morton, R. P. Johnson.

McLENNAN—COLIN CAMPBELL, of Toronto, Ont. Born at Port Arthur, Ont., April 5th, 1881; Educ., Grad. R.M.C., Kingston, 1901, Lieut. 48th Bengal Pioneers, 1901-07; 1909-13, asst. engr., H.E.P.C. of Ontario on field surveys etc.; 1913-16, dist. hydrometric engr., at Kenora & Ottawa; 1916 to date, hydrometric engr., H.E.P.C. of Ontario.

References: F. A. Gaby, H. G. Acres, T. H. Hogg, M. V. Sauer, J. B. Challies, G. H. Ferguson.

McMILLAN—HERBET WILLIAM, of Lachine, Que. Born at Lachine, July 31st, 1884; Educ., I.C.S. (bridge engr'g); Up until 1905, supt. office & shop inspection, Dominion Bridge Co.; 1905-06, inspection work, Vautlet & St. George Inspection Co.; 1907-12, bridge inspector, C.P.R.; 1913, supt. of inspection, Eastern Lines, Bridge Dept., C.P.R.; 6 mos., chief shop inspector, St. Lawrence Bridge Co.; 1914-16, chief shop inspector and chief field inspector on Quebec Bridge; 1917-19, chief inspector & asst. mech. supt., Dominion Bridge Co.; At present, Works Supt., Dominion Bridge Co., Lachine.

References: P. Johnson, G. H. Duggan, F. C. McMath, C. N. Monsarrat, P. B. Motley, G. F. Porter, F. P. Shearwood.

MEDLEN—EDWARD MONTAGU, of Hamilton, Ont. Born at Halifax, N.S., Nov. 11th, 1891; Educ., 3 yrs. Queen's Univ.; 1909 (summer), rodman and instr'man, Govt. survey; 1910 (summer), drill-helper, Helen Mine; 1911-14, (Apr.-Sept.), instr'man and making maps for magnetometric survey of Mond Nickel Co.; 1914-19, overseas, Can. Engrs., From Sept. 1919 in charge of engrs training at Can. Engrs Depot, France; April 1920 to date, dftsman, Hamilton Bridge Works Co. Ltd., Hamilton.

References: H. L. Malcolm, H. R. Lordly, D. S. Ellis, J. A. McFarlane, H. B. Stuart.

O'BRIEN—JOHN EDWIN, of Toronto, Ont. Born at Pembroke, Ont., Feb. 8th, 1896; Educ., B.A.Sc., Univ. of Toronto, 1917; 1 summer, asst. engr., D.P.W., Toronto Harbour Breakwater Constrn.; 1 year, surveying, Dept. of Mines; 1 year, 2nd asst., D.L.S., Peace River District; 1917 (4 mos.), engr. with Fegles Bellows, Port Arthur; 1919-20, engr. for J. V. Gray Construction Co., Toronto, and at present purchasing agent for same firm.

References: C. R. Young, P. Gillespie, F. S. Milligan, R. O. Wynne-Roberts, W. W. Gunn, N. L. Croshie, R. G. Bangs, A. Gibson.

PATTERSON—EDWARD GEORGE, of Peterboro, Ont. Born at St. Catharines, Ont., March 20th, 1866; Educ., Collegiate Institute; 29 years with Canadian General Electric Co., 20 years as manager of Peterboro works.

References: L. DeW. Magie, P. P. Westbye, J. A. G. Goulet, P. L. Allison, V. S. Foster, B. L. Banns, A. L. Killaly, G. R. Langley.

PERRY—OLIVER MOWAT, of Windsor, Ont. Born at Myer's Cave, Ont., Feb. 14th, 1885; Educ., B.Sc. Queen's Univ., 1909, 2 summers, elect'l dept., C.P.R. Angus shops, 1909-10, engr'g dept., Toronto Electric Light Co., 1910-13, engr., for Smith Kerry & Chace, Toronto, 1913-20, engr. in full charge of design etc., Windsor Hydro-Electric System, and on completion mgr. in full charge.

References: H. B. R. Craig, W. J. Forbes-Mitchell, A. J. Stevens, H. Thorne, M. E. Brian.

PARKER—THOMAS WINT WEIR, of Montreal, Que. Born at Dumbarton, Scotland, Sept. 20th, 1885; Educ., Royal Technical College, Glasgow. Assoc. Mem. I.C.E., England, 1910; 1901-06, pupil in city engr's office, Glasgow, 1906-11, asst. engr. in city engr's office, Glasgow, 1911 (2 mos.), instr'man, So. Vancouver Municipality; 1911-12, dftsman., city engr's office, Prince Rupert, 1912, with G.T.P. Rly., as asst. on layout of new terminals, Prince Rupert; 1912-15, asst. city engr., Prince Rupert; 1916, engr's office, Atchison, Topeko & Santa Fe Rly., Chicago; 1916-19, overseas, C.R.T., and Lieut. R.E., At present asst. to A. D. Swan, Montreal.

References: A. D. Swan, J. McGregor, C. Brackenridge, W. I. Bishop, J. T. Farmer, T. W. Harvie.

POOLE—ERNEST EDWARD, of Regina, Sask. Born at Cardigan, P.E.I. Oct. 18th, 1883; Educ., I.C.S.; 1902-05, foreman and supt. concrete and bldg. constrn. etc.; 1906 to date, contracting and engr'g as follows, 1906, Martin & Poole, 1907, Poole & Bruce, 1907-13, E. E. Poole, 1914-20, Poole Constrn. Co. Ltd., and at present Pres. & Mgr., of last mentioned company.

References: J. H. Puntin, J. N. deStein, E. G. W. Montgomery, E. A. Markham, A. J. McPherson, H. G. McVean, H. A. Mackay.

POPE—CHARLES ARTHUR, of Calgary, Alta. Born at Winnipeg, Man., June 12th, 1888; Educ., 1 year Science McGill Univ., 1907-08; 1908-10, dftsman, rodman, on rly. constrn. and location; 1910-15, ch. dftsman., C.P.R. Constrn. Dept., Alta. & B.C.; 1915-17, concrete inspector, and instr'man, Connaught Tunnel, 1917-18, instr'man., C.P.R.; 1918-20, dftsman and asst. engr., Alberta Flour Mills Ltd., Calgary; May 1920 to date, concrete inspector, C.P.R., D.N.R., Taber Irrigation District.

References: W. A. James, J. R. C. Macredie, F. W. Alexander, A. Ingraham, G. P. F. Boese, H. W. Tye, T. Lees.

PORTER—THOMAS HENRY, of Portage la Prairie, Man. Born at Studley, England, April 12th, 1878; Educ., Birmingham Technical College; 2 yrs. hydraulic dept., Tang & Birney; 2 yrs. Birmingham Water Works as inspector, and asst. road engr., Warwickshire County Council; 1907-09, water works engr., Yorkton; 1909-16, contracting; 1916-19, machinist, Vulcan & Canadian Pacific; 1919 to date, city engr., Portage la Prairie, Man.

References: W. M. Scott, D. L. McLean, A. Findlay, J. Veitch, P. Burke-Gaffney, H. S. Cameron.

PULLAR—JAMES, of Moncton, N.B. Born at Dundee, Scotland, Dec. 22nd, 1888; Educ., Dundee Technical School; 1904-10, articled ap'tice and dftsman, to David Smart, Architect & Surveyor, Perth, Scotland; 1910-12, arch. dftsman. White, Sherbrooke, Que., and Peden & McLaren, Montreal; 1913-15, arch'l dftsman., C.P.R.; 1915-17, arch'l dftsman., C.G.R.; 1917-19, overseas; At present architect, dftsman., & designer, C.N.R., Moncton.

References: W. A. Duff, H. J. Crudge, F. B. Tapley, C. B. Brown, S. B. Wass, F. B. Fripp.

REDING—THOMAS AUGUSTINE, of Hamilton, Ont. Born at Ancaster Ont., Dec. 31st, 1894; Educ., Technical Course, Hamilton Collegiate. A.C.S. Course in civil engr'g; 1913 (Apr.-Aug.), rodman, MacKay, MacKay & Webster, Hamilton; 1914 (Aug.-Dec.), with A. M. Jackson, O.L.S.; 1915 to '17, rodman and in charge of survey party, MacKay, MacKay & Webster; 1917-18, instr'man on constrn., Toronto Hamilton & Buffalo Rly.; 1918-19, overseas, Can. Engrs.; 1919 to date, with MacKay, MacKay & Perrie, Hamilton.

References: R. L. Latham, A. M. Jackson, W. B. Ford, F. W. Paulin, E. R. Gray.

RICHARDSON—ARTHUR BEAMER, of Toronto, Ont. Born at Walkerton, Ont., Oct. 4th, 1884; Educ., 2 yrs. S.P.S., Univ. of Toronto; 15 mos. mach. shop, Cowan & Co., Galt, Ont.; 4 yrs. dfting room, Canadian Bridge Co.; 3 yrs. Canada Foundry Co.; 3½ yrs. St. Lawrence Bridge Co.; 1 yr. Toronto office, Graham, Anderson, Probst & White, of Chicago, on design of three large stores etc.; 3 yrs. asst. to chief dftsman., and at present checker in dfting office, Dominion Bridge Co., Toronto.

References: G. F. Porter, E. S. Mattice, J. W. Moffat, A. H. Harkness, J. W. Smith, G. E. Evans, W. W. Gunn, J. G. Jack.

ROBERTS—CHARLES DRURY, of Toronto, Ont. Born at St. Ives, England, Aug. 17th, 1877; Educ., Glasgow & West of Scotland Technical Institute. Engr'g., Oudle School, 1896; Assoc. Member Inst. of Mech. Engrs., London, England; 1896-1900, premium pupil, Fielding & Platt, Gloucester, England; 1900-01, designing dftsman with above firm; 1901-02, fitter and erector, London & South Western Railway, London; 1902-07, dftsman, Central South African Rlys., Pretoria; (fought in Zulu Rebellion); 1909-10, dftsman, master car builder, C.P.R., Angus Shops, Montreal; 1910-20 (with exception of 1916-19 when overseas), mech'l and designing engr., Dept. of Works, Water Supply Section, City Hall, Toronto.

References: G. G. Powell, J. Milne, W. Gore, W. Storrie, W. R. Worthington, C. L. Fellowes, T. Taylor, I. H. Nevitt, G. Phelps.

ROBERTSON—ROBERT WALLACE, of Hamilton, Ont. Born at Hamilton, Nov. 29th, 1893; Educ., Hamilton Collegiate Institute; 1913 (Apr.-Dec.), rodman, MacKay, MacKay & Webster, Hamilton; 1914-15, car service dept., Toronto, Hamilton & Buffalo Rly.; 1915-19, overseas, 31st Bty., C.F.A.; 1919 to date, asst. on gen'l survey & engr'g. work, MacKay, MacKay & Perrie, Hamilton.

References: F. W. Paulin, W. B. Ford, E. R. Gray, E. H. Darling, C. R. Murdock.

ROSS—ARCHIBALD HOLMES, of Montreal, Que. Born at Pictou, N.S., April 10th, 1868; Educ., High School; 1887-1896, I.C.Ry., shop & dfting office, last 3½ yrs. designing; 1896-98, works mgr., James Cooper Mfg., Co. Ltd., Montreal; 1898-1905, designing engr., Laurie Engr'g Co., Montreal; 1905 to date, Ross & Greig, Consulting Engineers.

References: J. H. Hunter, F. B. Brown, G. R. MacLeod, S. F. Rutherford, R. E. Hunter, R. A. Ross.

ROSS—HENRY JAMES, of Toronto, Ont. Born at Aberdeen, Scotland, Dec. 25th, 1884; Educ., Robert Gordon's College technical classes; Articled pupil city engrs. office, Aberdeen; 4 yrs. mech. engr'g training; 1909, in charge of field work, bridge section, city Engr's office, Toronto; 1910, in charge of field work, Toronto Main Drainage, Adelaide St. Section; 1910 to date, ass't. engr., in charge of field work & design of casting in Water Main Extension Section, Works Dept., Toronto.

References: C. L. Fellowes, J. Milne, I. H. Nevitt, W. R. Worthington, G. G. Powell.

ROWBOTHAM—ALLAN EDWARD, of Edmonton, Alta. Born at Wrexham, North Wales, June 3rd, 1886; Student Inst. C.E.; 1902-05, articled pupil to A. E. Johnson; 1906-09, asst. engr., Denbighshire County Council & Wilson & Sons, Rly. Contractors; 1909-11, dftsman on prelim. location & inspection of piling, Alberta Central Rly.; 1912, topog'r on survey of Brazeau Coal Claims, asst. to Cautley & Carthew, Alberta Land Surveyors; 1912-13, topog'r prelim. location, Alberta Peace River & Eastern Rlys.; 1914, rodman, Edmonton, Dunvegan & B.C.Ry.; 1914-20, overseas, C.M.R. & Major Royal Engrs.; At present asst. to Major G. W. MacLeod, Edmonton.

References: G. W. MacLeod, B. J. Saunders, J. G. MacGregor, R. G. Dawe, C. H. Pozer, W. F. Stevenson, G. W. F. R. Evans.

RUTLEY—FREDERICK GEORGE, of Fairville, N.B. Born at Toronto, Ont., Sept. 28th, 1890; Educ., B.A.Sc. Univ. of Toronto, 1912; 1911, engr., Jennings & Ross Ltd., Toronto; 1912, instr'man, field survey, The Alberta Interurban Rly. Co., Calgary; 1913, designer and field engr., Calgary Power Co. Ltd.; 1915-18, Lieut., Capt. and A-Adjutant, C.E.F.; 1914-15 and 1919 to date, res. engr. on various works for The Foundation Co. Ltd.

References: C. W. Allen, R. E. Chadwick, F. S. Kuhns, L. C. Jacobs, G. L. Shanks.

SINCLAIR—ALEXANDER GIBSON, of Edson, Alta. Born at Biggar, Scotland, July 28th, 1885; 1901-06, pupilage in architecture with Trail & Stewart, Architects & Surveyors, Lanark, Scotland; 1906-10, asst. ch. dftsman & bldg. insp'r. with above company; 1910-14, ch. dftsman., asst. engr's office, G.T.P., Melville, Sask.; 1914-19, overseas, instructional officer, Can. Pioneers & Can. Mach. Gnrs.; 1919 to date, instr'man., mtce. of way, C.N.R.

References: L. J. Devereux, H. A. Bowden, W. S. Fetherstonhaugh, M. A. Burbank, R. W. Ross, J. N. deStein.

SMITH—FRANK LAWRENCE, of Hamilton, Ont. Born at Liverpool, England, Dec. 18th, 1890; Educ., Special 2 yr. course in C.E. Univ. of Liverpool. 1st class cert. Board of Educ'n., London, England, in steam & heat engines etc.; 1906-11, secretary to engr'g dept., Univ. of Liverpool; 1912, asst. to Dr. Bengough, Liverpool, as dftsman on special govt. research; 1913-20, dftsman & checker, Dominion Bridge Co., Lachine, loaned to consltg. engr., Parliament Bldgs., Ottawa in 1916 and to U.S. Shipping Board in 1918; Jan. 1920 to date, checker in dfting dept., Hamilton Bridge Works Co., Hamilton.

References: J. A. McFarlane, R. K. Palmer, D. C. Tennant, P. L. Pratley, A. Peden, Jr.

SMITH—GEORGE ELLIS, of Moncton, N.B. Born at Fredericton, N.B., Nov. 14th, 1889; Educ., B.Sc., Univ. of New Brunswick, 1912; 1908-12, field work in conjunction with course in engr'g.; 1912 (May-Nov.), rodman, St. John & Quebec Rly.; 1912-14, instr'man on constrn., St. John & Quebec Rly.; 1914-16, yard supt., Fraser Lumber Co.; 1916-19, overseas; 1919 to date, dftsman., ch. engr's office, C.N.R., Moncton. (Member Assoc. of Prof. Engrs. of Prov. of New Brunswick.)

References: W. A. Duff, S. B. Wass, E. G. Evans, F. B. Fripp, J. S. O'Dwyer, J. M. Millar, M. J. Murphy.

SMITH—HUGH SUTHERLAND, of Regina, Sask. Born at Shelburne, Ont., July 24th, 1890; 1909-11, arts course, Univ. of Sask., 1914-15, 1st year, civil engr'g., Univ. of Toronto, 2nd year work, Univ. of Sask.; 1910-11-12 (summers), rodman & instr'man Phillips Stewart & Lee, Saskatoon; 1913-14 (summers), inspector & instr'man., City of Saskatoon; 1915 (May-July), with R. J. Lecky Constn. Co., Saskatoon; 1915-19, overseas; 1919 (Aug.-Dec.), instr'man and foreman, sewer & water main constrn., Saskatoon; May 1920 to date, field engr., Sask., Water Supply Commission.

References: A. J. McPherson, W. M. Stewart, H. McI. Weir, C. J. Yorath, J. Marshall, E. H. Phillips.

SMITH—HERBERT THOMAS, of Toronto, Ont. Born at Norwich, England, Dec. 21st. 1888; 1903-08, ap'ticeship marine engr'g., Crabtree Ltd., Gt. Yarmouth; 1908-11, workshop practice, turbine tests and adjustments of turbine engines with J. T. Thorneycroft Ltd., England, and J. S. White Ltd., Cowes, England. Also dock work for Royal Mail Steam Packet Co., Southampton, England; Two years at sea in charge of electric & hydraulic plant for R.M.S.P. Co.; 1911-14, in charge of misc. surveys for C.P.R.; 1915-16, drawing office work, Curtiss Aeroplanes; 1916 (June-Dec.), drawing office, Dom. P.W.D.; 1916 to date, dftsman, H.E.P.C. of Ontario.

References: H. G. Acres, T. H. Hogg, A. E. Nourse, H. F. Hebert, R. Morham, R. M. Carmichael.

SMITH—OLIVER, of Lindsay, Ont. Born at Beaverton, Ont., May 22nd, 1891; Educ., Undergrad. Queen's Univ., Private study. O.L.S., 1916; 1911, engr'g and surveying work, Mond Nickel Co., Coniston, Ont.; 1911-14, sewerage surveys etc.,for towns of Lindsay, Port Hope and Midland; 1916, commenced practice as O.L.S. and municipal engr.; 1917 to date, full charge as town engr., Lindsay, and from 1918 also county engr., Victoria County.

References: F. A. Dallyn, F. R. Wilford, W. Chipman, G. H. Frith, H. E. Maple.

SMITH—P. M., of Hamilton, Ont. Born at Rockland, Mass., Nov. 20th, 1873; Educ., B.S., Mass. Inst. of Tech., 1897; 1897-1907, with various engrs. in Mass., U.S.A.; 1907-15, supt. of mfg. and chief mill engr., Zimmerman Mfg. Co., Hamilton; 1915-17, chief engr., T. Eaton Co. Factories; 1917 to date, chief engr., W. J. Westaway Co. Ltd.

References: E. R. Gray, F. W. Paulin, R. K. Palmer, C. H. Marrs, R. S. Kelsch, R. L. Latham, F. W. Hubbard.

SPENCE—HOWARD NATHANIEL, of St. Croix, N.S. Born at St. Croix, June 26th, 1899; Educ., 3 yrs. Kings College. At present attending N.S. Technical College; 1917 (summer), rodman and recorder, geol. survey; 1918, instr'man and camera man, topog'l survey, G.S.C., Brittania Mines, Howe Sound, B.C.; 1919 (summer), ch. asst. triang. survey, G.S.C.; 1920 (summer), ch. asst. Topog'l survey, G.S.C.

References: J. F. Lumsden, W. G. Hardy, F. R. Faulkner, R. L. Nixon, I. P. MacNab, R. R. Murray.

SPRECKLEY—JOHN ALFRED, of Calgary, Alta. Born at London, England, June 10th, 1875; Educ., Assoc. Mem. Inst. C.E., 1901, Professional C.E. of Alta., 1920; 1896-1903, asst. to city engr., Hereford, England; 1904-12, burough engr. & surveyor, Ludlow, England; 1913, architect's supt. of constrn., Ottawa; 1913-19, Water Administration Engr., Dept. of Interior, Ottawa, and from 1919 to date at Calgary, Alta.

References: R. J. Burley, C. Chambers, A. L. Ford, G. N. Houston, P. J. Jannings, F. H. Peters.

STEDMAN—ERNEST WALTER, of Ottawa, Ont. Born at Malling, Kent, England, July 21st, 1888; Educ., Assoc. of Royal College of Science, London, England, 1910. Whitworth Exhibition 1907. Whitworth Scholar 1910. Bayliss Prize at Inst. of Civil Engrs. Exam. 1910. A.M.I.C.E. 1910-11, special course at Central Technical College, London; 1903-07, ap'ticeship H.M. Dockyard, Sheerness, England; 1911-12, dftsman., J. I. Thornycroft & Co., Southampton, England, and (evenings) lecturer, mech. engr'g. Hartley University; 1912-13, asst. engr., Sturtevant Engr'g Co., London; 1914-19, tech. officer, Naval Air Service & R.A.F. on design, constrn. etc. of aircraft. Deputy asst. controller for design Dept. Air Ministry. Also C.O. No. 4 Aeroplane Supply Dept., France; 1919-20, chief of tech. staff, Handley Page Ltd., London, Eng.; At present, Director, Technical Section, Air Board, Ottawa.

References: R. J. Durley, J. A. Wilson, R. H. Mulock, C. P. Edwards, F. C. Higgins.

SWORD—ARTHUR D., of Toronto, Ont. Born at Toronto, April 14th, 1888; Educ., B.A.Sc., Univ. of Toronto, 1911; 1911-14, reinforced concrete design with C. W. Noble, Toronto; 1915, instr'man., Toronto-Hamilton Highway Commission; 1916-18, shell testing with R. J. Marshall, Toronto; 1919-20, constrn. supt., Canadian Mill Products; 1920 (5 mos.), reinforced concrete design, W. J. Westaway Co., Hamilton.

References: J. Erskine, A. E. Nourse, F. T. Nichols, C. P. VanNorman.

THEAKSTON—HAROLD RAYMOND, of Halifax, N.S. Born at Moncton, Vt., U.S.A., May 11th, 1895; Educ., 2 yrs. engr'g. Dalhousie Univ., 1 yr. Mining, N.S. Tech. Coll.; 4 yrs. C.E.F., Lieut. and Adjutant; 1920 (summer), N.S. Steel & Coal Co., Wabana, Nfld., six weeks acting engr.; At present in final year N.S. Tech. College.

References: F. R. Faulkner, J. F. Lumsden, F. A. Bowman, I. P. MacNab, R. R. Murray, C. B. Archibald, J. B. Gilliatt.

TITUS—HARRISON BURRELL, of Moncton, N.B. Born at Digby, N.S., Oct. 27th, 1892; Educ., Engr'g Diploma, Mt. Allison Univ., 1914; Grad. Can. School Mil. Engr'g., Seaforth, England; 1913 (June-Dec.), on Car Ferry Terminal, Cape Tormentine, N.B.; 1914-15, dftsman on above; 1915-19, overseas, officer C.E.F.; 1919 to date, transitman and concrete inspector.

References: E. G. Evans, S. B. Wass, F. B. Fripp, W. A. Duff, M. J. Murphy.

TROST—PAUL ANTHONY, of West Hoboken, N.J., U.S.A. Born at Jersey City, March 9th, 1877; Educ., 6 mos. U.S. Naval Academy; 1893-98, private study while with various architects and engrs.; 1898-1901, with International Paper Co. as field asst. to divn. engr. on plant upkeep, etc.; 1901-02, in map business; 1902 (Mar.-Nov.), dftsman for Geo. F. Hardy; 1902-03, surveys & designs for water power & paper mill for Ryegate Paper Co., Ryegate, Vt.; 1903-18, with Geo. F. Hardy as dftsman, designing engr., field engr. and office asst.; 1918-19, asst. mgr. and mgr., New York District Production Division Emergency Fleet Corps; 1919 to date, office asst., with Geo. F. Hardy, Consltg. Engr.

References: G. F. Hardy, M. J. Leahy, C. A. Waterous, E. S. Mattice, W. I. Bishop, H. A. Morrow, J. O. Bonin, L. B. Kingston.

TURNER—MYRON WILLIAM, of Fort William, Ont. Born at Long Island, Kansas, U.S.A., Jan. 2nd, 1884; Educ., Civil Engr., Cornell Univ., 1911; 1905 (summer), rodman on irrigation survey, Tri-State Land Co., in Western Nebraska; 1910 (summer), revision of Crandhall & Barnes "Transition Curves" and computation of all tables; 1911-15, levelman, transitman & ass't. engr., engr'g dept., C.P.R.; 1915-19, with Can. Explosives as supervisor, dept. mech. supt. and asst. mech. supt., in charge of all constrn. work and mech. repairs.; At present asst. to engr. in charge of constrn. of $3,000,000 pulp & paper mill for the Management Engr'g & Development Co., Dayton, Ohio.

References: C. B. Brown, S. B. McConnell, D. A. Molitor, D. G. Calvert, H. R. Miles, J. W. McMahon, H. T. Ruhl.

TYLER—WILLIAM GRANT, of Montreal West, Que. Born at Montreal, Jan. 18th, 1890; Educ., B.Sc., McGill Univ., 1914; 1914, motor and transformer test, Canadian Westinghouse Co.; 1915-16, operated hydro-electric plant, Northern Ontario Light & Power Co.; At present cable engr., Northern Electric Co.

References: G. E. Templeman, A. Peden, Jr., F. Peden, N. L. Morgan, A. J. Lawrence, T. Eardley-Wilmot.

UTLEY—REGINALD ALBERT, of Port Arthur, Ont Born at Toronto, Ont., Jan. 2nd, 1890; Educ., 2 yrs. Faculty of Engr'g , Univ. of Toronto; 1909-11, ap'tice, Unwin, Murphy & Esten, Land Surveyors, Toronto, and 6 mos. dftsman with H.B Proudfoot, Engr. & Surveyor, Toronto; 1911-14, rodman, record keeper, dftsman, and chief clerk, C.P.R.; 1915-18, overseas; 1918 (Apr.-July), D.N.R., C.P.R., Calgary; 1918-20, asst. engr., constrn. dept., C.N.R., Edmonton & Winnipeg; Feb. 1920 to date, asst. engr., mtce. dept., C.N.R. Port Arthur, Ont.

References: D. Hillman, A V Redmond, A. J. Gayfer, H L. Sherwood, R. A. Girouard, C. A. D'Abbadie, J. Paris, C. F. Summers.

VILLENEUVE—THOMAS LOUIS, of Chicoutimi, Que. Born at St. Alphonse, Que., Sept. 2nd, 1881; Educ., Grad. S.P.S., Univ. of Toronto, 1908; B.Sc., Laval Univ.; 1908 (9 mos.), town engr., Chicoutimi; 1908 to date, asst to dist. engr , D.P.W., Chicoutimi-Saguenay District, and at present senior asst.

References: K. M. Cameron, J. A. Claveau, P. Gillespie, J. A. Smith, E. Lavoie, A. D. Huether.

WALKER—GEORGE STUART, of Kingston, Ont. Born at Cocanada, India, Aug. 15th, 1893; Educ., At present 3rd year student Applied Science, Queen's Univ.; 4 yrs. asst. to D.L.S.; 3 yrs. 10 mos., overseas with Can. Engrs.

References: A. Macphail, W. P. Wilgar, W. L. Malcolm, D. S. Ellis, L. T. Rutledge.

WALLACE—DAVID A., of Montreal, Que. Born at Savannah, Ohio, July 12th, 1884; Educ., special course in civil engr'g Northwestern Univ. and Univ. of Illinois, 1902-06; 1907-08, supt. of constrn. Frisco Lines; 1909, roadmaster, Tennessee Central R.R.; 1910, asst. engr. on location, Nazos Valley and Pacific R R. Mexico; 1911, roadmaster, dep't. of constrn., Ft. Dodge, Des Moines & Southern R.R.; 1912, roadmaster, Central Vermont Rly.; 1912-16, res. engr., C.P.R.; 1916-17, head of divn., purchasing dept., Imperial Munitions Board ,Ottawa; 1917-18, Capt., Corps of Engrs., A.E.F.; 1919 with American Relief in Balkans; 1920, engr., Chicago City Railway Terminal Commission; At present, asst. engr., Dept. Rlys. & Canals, G.T.R. Arbitration.

References: R. A. C. Henry, F. W. Cooper, M. A. Fullington, J. M. R. Fairbairn, A. C. MacKenzie.

WILBUR—ARTHUR WILLARD, of Chatham, B.N. Born at Dorchester, N.B., March 5th, 1883; Educ., B.A.I., Univ. of New Brunswick, 1905; 1905 to date, asst. engr., D.P.W. of Canada, Chatham.

References: G. Stead, G. E. Martin, A. R. Crookshank, F. G. Goodspeed, R. J. S. Sly, A. W. Gregory, R. H. Emmerson, W. R. Campbell.

WILSON—HARRY VANCE, of Hamilton, Ont. Born at Antwerp, Ohio, Feb. 22nd, 1879; Educ., C.E., Ohio Northern Univ., 1906; Previous to college work, land surveying, road repairs, concrete inspection; 1906-07, detailer of struct'l steel, American Bridge Co., Ambridge, Pa.; 1908, detailer and checker, Hay Fdy. & Iron Works, Newark, N.J.; 1909, checker, Virginia Bridge & Iron Co., Roanoke, Va.; 1910-18, chief checker of bldg. work, Hamilton Bridge Works Co.; 1918-19, master checker of hull fittings & pipe work, American Inst. Ship Bldg. Corp., Hog Island, Pa.; 1919 to date, in charge of bldg. dept. dfting, Hamilton Bridge Works Co., as asst. to chief dftsman.

References: J. A. McFarlane, R. K. Palmer, C. H. Marrs, E. H. Darling, J. G. Campbell, G. A. Colhoun.

WINTER—THOMAS HINSON, of Halifax, N.S. Born at St. John's, Nfld., Feb. 17th, 1895; Educ., At present 3rd year student civil engr'g., N.S. Technical College; Summers 1917 and 1919, civil engr's office, Dominion Iron & Steel Co., Wabana, Nfld.; 1920 (summer), instr'man, Nova Scotia Highways Board.

References: F. R. Faulkner, W. G. Hardy, R. L. Nixon, J. W. Morrison, J. F. Lumsden.

YARWOOD—PERCY FREDERICK (Capt. R.E.), of Alix, Alta. Born at Picton, Ont., Feb. 4th, 1893; Educ., 2nd year Applied Science, Univ. of Alberta, 1915-16; 1912 (3 mos.), rodman, location survey, C.N.R.; 1912-13, dftsman, location survey, C.N.R.; 1913 (Feb.-May), asst. mining engr., Canmore Coal Co., Canmore, Alta.; 1913-15 (summers) asst. district survey and engr. in Vigreville District on prov. road work; 1917-18, Capt., Royal Engrs., commanding detachment of Field Survey Company, Royal Engrs., Wounded 1918, (still disabled).

References: L. T. Bray, A. W. Haddow, D. W. Ritchie, L. C. Charlesworth, C. Flint.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

BARNHILL—BRUNSWICK EDWARD, of Sault Ste. Marie, Ont. Born at Joggings Mines, N.S., Sept. 26th, 1880; Educ., B.Eng., King's College, 1899; 1899-1900, rodman, instr'man. and asst. to the supt. of constrn. during the building of Dominion Iron & Steel Works; 1900-09, instr'man. and since 1906 res. engr., G.T.P. Ry., Northern Ontario; 1909 (3 mos.), locating engr., Farmer's Rly. Co., of Sask.; 1910, engr., mtce of way, and in charge of regrading, bridges etc., Algoma Central & Hudson Bay Rly. from Sault Ste Marie north 120 miles; 1911-16, divn. engr., Algoma Eastern Rly.; 1916 to date, chief field engr., Algoma Steel Corpn., Sault Ste Marie.

References: R. S. McCormick, A. Allaire, H. B. R. Craig, C. S. Gzowski, Jr., J. S. H. Wurtele, R. E. Chadwick, N. L. Somers, L. L. Jacobs.

BEAUBIEN—JAMES deGASPE, of Outremont, Que Born at Outremont May 18th, 1881; Educ., B.Sc , McGill Univ , 1906; 1901 & 1903, electrolysis Montreal Light Heat & Power Co ; 1904, electrolysis, Shawinigan Water & Power Co , 1907 demonstrator, elect'l engr'g , McGill Univ , 1908, tests with Westinghouse Electric & Mfg. Co ; 1909 to date, consulting engineer, Montreal.

References: L. A. Herdt, R. S. Kelsch, R. A. Ross, J. C. Smith, R. M. Wilson, F. B. Brown, K. B. Thornton.

CHADWICK—RICHARD ELLARD CARDEN, of Montreal, Que Born at Toronto, Ont , Feb. 16th, 1885; Educ , Grad with Honours S.P.S , Univ of Toronto, 1906; 1904 (summer), dftsman , Chadwick Beckett, Architects, Toronto; 1905 (summer), roadways branch, city engr's office, Toronto; 1906 (May-Aug), with Haney & Miller, Gen'l Contractors; 1906-07, dftsman , bridge dept , Canada Foundry Co Ltd ; 1908-09, partner, Oxley & Chadwick; 1909-10, engr of bridges & Locks, city engr's office, Toronto; 1911, supt. of constrn., Woolworth Bldg., for The Foundation Co., New York; 1911-14, The Foundation Co Ltd., Montreal, supt. on constrn , & engr in charge of Engr'g & estimating dept.; 1915, asst to gen. mgr , The Foundation Co., New York; 1916, acting ch. engr , with above firm; 1917-19, mgr , and 1920, gen. mgr., The Foundation Co. Ltd., Montreal

References: F. S. Keith, H. Holgate, J. M. R. Fairbairn, G. H. Duggan, J. W. Doty, J. G. Sullivan, C. N. Monsarrat.

DAWES—ANDREW SIDNEY, Major, M.C., of Montreal, Que. Born at Lachine, Que., Dec. 5th, 1888; Educ., B.Sc , McGill Univ., 1910; 1907 (summer), with C.P.R.; 1910, ap'ticeship course, Canadian Westinghouse; 1911-12, mgr., Collyer & Brock's Electrical Contractor's, Saskatoon office; 1913-15, designer of reinforced concrete and estimator The Atlas Constrn. Co., Montreal; 1915-19, overseas, Major C.F.A., Wounded, Awarded M.C.; 1919 to date, vice-pres. and contracting engr., The Atlas Constrn. Co., Montreal.

References: C. M. Morssen, L. A. Amos, J. P. Anglin, F. B. Brown, E. G. M. Cape, W. D. Lawrence, H. R. Little, J. C. McDougall, A. G. L. McNaughton.

ELLACOTT—CHARLES HERBERT, of Victoria, B.C. Born at London, England, Dec. 24th, 1866; Educ., B.Sc., McGill Univ., 1890; 1887 (summer), rodman, Gatineau Valley Rly.; 1888 (summer), instr'man & dftsman., Jos. Rielle, Montreal, and in charge of party, townships sub-divn., Willis Chipman; 1889, asst. engr., Willis Chipman; 1890, asst. engr , re-measurement, Fraser Canyon, C.R.Ry., and to J. H. Gray; 1891, asst. engr., Govt. Nor. Rly., Idaho; 1891-93, in charge field and office, Gore Burnett & Co., Victoria, B.C. (joined firm); 1893, B.C.L.S. Comm'n.; 1893-97, private practice, Kasla & Rossland, B.C.; 1898, surveys for Shawinigan Power development etc.; 1899, D.L.S. Comm'n.; 1899-1901, private practice, Greenwood & Grand Forks, B.C.; 1901, water conservation investigations etc.; 1902, drainage engr., N.W.T. Govt.; 1903, private practice, Regina; 1904-05, asst. engr., C.P.R. & C.N.R.; 1907-17, private practice, Victoria, B.C.; 1918-19. reclamation Service, Dom. Govt.; 1919 to date, locating & asst. chief engr., Cortez Oil Corpn., Tampico, Mexico.

References: W. F. Tye, J. M. R. Fairbairn, W. P. Anderson, W. I. Bishop, F. A. Wilkin, A. W. R. Wilby, H. E. T. Haultain, R. J. Burley.

FOX—CHARLES HARRY, of Winnipeg, Man. Born at Winnipeg, April 2nd, 1885; Educ., B.Sc. (C.E.) 1909, M.Sc. 1910, McGill Univ.; 1902-09 (except college terms), clerk, rodman, transitman, C.P.R.; 1910 to date (except 1 year with C.E.), with C.P.R. as res. engr., asst. div. engr., div. engr., and at present asst. dist. engr.

References: J. G. Sullivan, F. Lee, J. C. Holden, W. G. Chace, H. M. MacKay, W. J. Dick, J. A. C. Macredie.

HORSFALL—HERBERT, of Leaside, Ont. Born at Sheffield, England, Jan. 27th, 1880; Educ., 1 yr. science, McGill Univ.; 1905-10, gen'l supt., Dominion Wire Mfg. Co., Lachine; 1910-16, works mgr , Canada Wire & Cable Co., Toronto; 1916-18, works mgr., Leaside Munitions Co., Leaside & St. Catharines Steel & Metal Co.; 1919 to date, vice-pres. & works mgr., Canada Wire & Cable Co. Ltd., Leaside.

References: A. L. Mudge, R. J. Durley, F. J. Bell, J. B. Carswell, W. A. Bucke, J. M. Robertson.

SILCOX—LEONARD ERNEST, of Winnipeg, Man. Born at Pembroke Dock, South Wales, April 3rd, 1882; Educ , Llandovey College, Wales; 1899-1902, articled pupil to Beesley Son & Nichols, Westminster, England; 1903 (May-Nov.), instr'man and res. engr. on Boyne Marsh Drainage Dist.; 1903-06, topog'r. leveller and transitman, G.T.P. Ry.; 1906-12, locating engr., G.T.P.Ry.; 1912-16, locating & divn. engr., Hudson Bay Ry.; 1916-19, overseas, sapper to Major, C.R.T.; Awarded D.S.O.; 1919 to date, locating engr., C.N.R., Western Lines.

References: G. C. Dunn, J. A. Hesketh, J. A. Heaman, H. A. Dixon, R. J. Gibb, C. L. Hervey.

STREET—JAMES CUNARD, of Lima, Peru. Born at Billings Bridge, Ont., Feb. 1st, 1886, Educ., B.A.Sc., Univ. of Toronto, 1911. O.L.S. 1912; 1905-06, rodman C.N.R.; 1907, instrman, Trent Canal; 1910 and 1911 (summers), instr'man., Toronto Filtration Plant; 1912-15, asst. engr., Welland Ship Canal; 1917, with Canadian Explosives Ltd., Beloeil Stn.; 1919, with Fraser Brace & Co., Turbine Stn., Ont.; At present with The Foundation Co., Lima, Peru.

References: J. M. Leamy, J. L. Weller, F. E. Sterns, W. H. Sullivan, J. C. Ball.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

MacKINNON—MURDOCH ASHLEY, of Ottawa, Ont. Born at Chatham, N.B., May 24th, 1891; Educ., B.Sc., Univ. of N.B., 1913; 1911 (summer), D.P.W., Chatham, N.B.; 1912 (summer), rodman on constrn., St. John Valley Rly.; 1913 (May and June), dftsman., Dominion Bridge Co.; 1913 to date (with exception of 27 mos. overseas), junior hydrographer, Hydrographic Survey, Ottawa; 1918, granted comm'n as Lieut., Royal Naval Volunteer Reserve, attached to Hydrographic Survey, Royal Navy, as surveying officer, 1st class, until August 1919.

References: W. J. Stewart, H. G. Parizeau, C. F. Hanington, F. Delaute, N. Wilson.

MERRYLEES—LOUIS FRANCIS, of Burlington, Ont. Born at Aberdeen, Scotland, Dec. 7th, 1887; Educ., 1905-08, Gordon's Technical College, Aberdeen; 1905-09, pupil to James Barron, M.I.C.E., Aberdeen; 1905-07, on surveys for harbour constrn. schemes; 1908, asst. to res. engr at Wick Harbour, Scotland; 1908-09, made survey and prepared plans etc. for harbour project, Lerwick, Shetland; 1909-10, instr'man and dftsman, Mason L. Brown & Co., Civil Engrs., and Landscape Gardeners, Detroit, Mich.; 1910-12, instr'man on mtce., C.P.R., Farnham, Que.; 1912-13, res. engr. on constrn. C.N.R.; 1913-14, employed by Board of Engrs., Quebec Bridge, in charge of constrn. and steel erection on south bank of St. Lawrence; 1914-19, overseas, Capt. and Acting Major, Royal Engrs.; 1920 (Jan.-June), with Algoma Steel Corpn., on constn. of mill at Sault Ste Marie; 1919 (Oct.-Dec.), with Kipawa Co., Temiskaming, Que.; June 1920 to date, with Dept. of Railways & Canals on valuation of G.T.R.

References: J. M. R. Fairbairn, A. C. Fellows, C. N. Monsarrat, W. J. Forbes-Mitchell, J. Rankin, F. S. Keith, A. C. Mackenzie.

MIDGLEY—FRANK HAROLD, of Galt, Ont. Born at Cambuslong, Scotland, May 26th, 1884; Educ., 1900-06, evening classes West of Scotland Technical College, at same time articled pupil to Nivin & Haddin, C.E. Glasgow; 1906, asst. civil engr., with above firm; 1906-07, dftsman., Dominion Bridge Co., Lachine; 1907-15, with C.P.R., as topog'r., leveller, dftsman., transitman and res. engr. on location and constrn.; 1915 to date, chief engr., Lake Erie and Northern & Grand River Rlys., Galt, Ont., in charge of location constrn. and mtce.

References: P. Johnson, J. M. R. Fairbairn, D. Hillman, R. B. Kenrick, J. Haddin.

PERRIE—WILLIAM WALLACE, of Hamilton, Ont. Born at Hamilton, June 3rd, 1894; Educ., private tuition, I.C.S. (civil engr'g.), O.L.S.; 3 yrs. ap'ticeship with James J. MacKay; 1913, rodman, MacKay, KacMay & Webster, Hamilton; 1914 (summer), field engr., Wm. G. Webster, sewer constrn., City of London; 1914-16, charge of party and gen'l surveying with James J. MacKay, O.L.S., Hamilton; 1917, practising O L.S. with James J. MacKay; 1918 to date, partner in firm MacKay, MacKay & Perrie, Hamilton.

References: F. W. Paulin, W. B. Ford, J. B. Nicholson, E. R. Gray, E. H. Darling.

WALKER—ROY MARSHALL of Montreal, Que. Born at Toronto, Ont., Jan. 24th, 1890; Educ., B.A.Sc. Univ. of Toronto, 1912; 1910-11, dftsman., Dominion Bridge Co., Montreal; 1911 (Aug.-Oct.), on location Moose Jaw Water Supply, for Walter J. Francis & Co.; 1912-14, asst. engr. & dftsman with above company; 1915 (Jan.-July), designing dftsman, Riordon Pulp & Paper Co.; 1915-18, production engr., Canadian Explosives, Ltd.; 1918 to date, asst. engr., in charge of constrn. and repairs, Canadian Explosives, Ltd.

References: W. J. Francis, F. B. Brown, A. B. McEwen, A. Peden, Jr., F. H. McKechnie.

WRIGHT—WILLIAM GORDON, of Montreal, Que. Born at Montreal, May 10th, 1891; Educ., Premium pupil, J. & E. Hall, Dartford, England, 1913. Cadet H.M.S. Conway, including course in naval architecture, 1908-10 Kent Council, England, Diploma, Machine design and constrn., 1914; 1907-08, dftsman, Linde Canadian Refrigeration Co; 1913-14, asst. erecting engr., on various shipyards in England, on refrigerating machinery on ships being built; 1914-15, machine designer, Linde Canadian Refrigeration Co.; Asst. naval engr., Dept. of Naval Service, in charge of tests and constrn.; Mgr., Refrigeration dept., John W. Ladd Co., Detroit, Mich.; In charge of design and erection of various refrigeration plants, and of two annealling furnaces for Admiralty; At present Marine Supt., Linde Canadian Refrigeration Co., Montreal.

References: E. D. Lafleur, L. A. Amos, R. deB. Corriveau, R. F. Uniacke, J. L. Busfield.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

ERRINGTON—CHARLES, of Calgary, Alta. Born at North Shields, England, Nov. 6th, 1899; Diploma, Royal Military College, 1920; 1919 (summer), B.C. land survey; At present Hydrometric Recorder.

References: F. H. Peters, F. K. Beach, G. H. Whyte, A. L. Ford, D. W. Munn.

MILLER—ALBERT SHERMAN, of Brighton, Ont. Born at Smithfield, Ont., Mar. 18th, 1885; Educ., B.A.Sc. (Honours), Univ. of Toronto, 1914; 1912 (5 mos.), topog'r & leveller on location survey, C.N.R., transitman on Dom. Govt., land survey Manitoba; 1913 (5 mos.), and 1914-15, inspector on bridges & sewers with Frank Barber; 1915-16, insp'r., ch. insp'r., dist. insp'r., on munitions for Dom. Govt.; 1916-17, res. engr., on constrn. of reinforced concrete & mill constrn. bldgs. in Toronto; 1917-18, overseas, 1st Bn. Can. Rly. Troops; 1919 to date, industrial engr., Dominion Canners Ltd.

References: B. Ripley, W. Chipman, P. Gillespie, F. Barber, C. R. Young, T. R. Loudon, E. R. Gray.

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

PUBLISHED MONTHLY AT 176 MANSFIELD STREET, MONTREAL

— BY —

THE ENGINEERING INSTITUTE OF CANADA

INCORPORATED IN 1887 AS

THE CANADIAN SOCIETY OF CIVIL ENGINEERS

ENTERED AT THE POST OFFICE, MONTREAL AS SECOND CLASS MATTER

VOLUME IV MONTREAL, FEBRUARY 1921 NUMBER 2

Report of Council for the Year Nineteen Hundred and Twenty

Last year's Council announced in its annual report that service to the individual member had been constantly in the minds of those guiding the destinies of *The Institute.* The present Council has carried out this policy in the hope of obtaining definite results. The suggestions of the Branches in this connection have been appreciated.

From an historic viewpoint the year nineteen hundred and twenty will loom large in engineering records. The discussion on legislation in nineteen hundred and eighteen, the action of *The Institute* in nineteen hundred and nineteen in preparing a proposed draft of an Act to regulate the practice of engineering, combined with the general interest taken by the various branches of *The Institute* in this subject, resulted in the passing of Acts establishing bodies of professional engineers and regulating the profession in the provinces of Quebec, Manitoba, Alberta, British Columbia, New Brunswick and Nova Scotia, with plans being made for similar legislation in Saskatchewan and Ontario.

Believing that the status of the profession depends upon the status of the individual the Council appointed a Committee on Classification and Remuneration, with a view to finding ways and means, if possible, of establishing a better state of affairs, particularly for those engineers employed in junior positions. The Committee has done a great deal of hard work and early in its labours became seized of the difficulty of establishing classifications and schedules of remuneration that would be satisfactory to all concerned. This Committee under the chairmanship of A. H. Harkness, M.E.I.C., of Toronto, made two progress reports which although not final showed that the report of Engineering Council on this subject was favoured by the Committee. This report was published in the October nineteen hundred and twenty *Journal* of *The Institute,* page four hundred and eighty-four. This Council expected to go down in history as the one to adopt on behalf of *The Institute,* classification and schedules, and recommends to the incoming Council that such be made effective at the earliest possible moment.

Realizing that changes in policy should be considered, a Committee on Policy was appointed, charged with the duty of making a report to Council embodying all possible suggestions designed to improve *The Institute.* This committee found its work to be somewhat on the same scale as that of the Committee on Society Affairs, appointed about five years ago, and is now engaged in co-operation with the Branches in a general survey of the situation having in view the increased usefulness and efficiency of *The Institute.* The result of this Committee's report will have an important bearing on future activities.

Important changes in the by-laws have been suggested and will come before the Annual Meeting for discussion. One of these is designed to give the junior members a more prominent place. Another which was suggested by petition of corporate members, aims to improve the procedure in cases of discipline and expulsion. Inasmuch as the revenue is not sufficient to maintain the expanding activities of *The Institute,* it is proposed to increase the dues to provide sufficient funds. It is believed that a large majority of the members of *The Institute* will favour this suggestion, if *The Institute* contemplates taking a more active part in national affairs and being of greater service to the individual.

During the year there has been a substantial increase in the membership of *The Institute.* An additional Branch at Moncton, New Brunswick, has been added to the list of those already in existence, and approval has been given for the establishment of a branch at Sydney, Nova Scotia, to be known as the Cape Breton Branch.

It is particularly gratifying to report the splendid Professional Meetings held during the past year, each one providing a maximum of interest to those present and bringing the members of the profession into a closer professional contact than that heretofore enjoyed. The first meeting was held at Montreal in conjunction with the Annual Meeting under the auspices of the Montreal Branch and was the largest gathering of engineers yet held. At Banff under the auspices of the Calgary Branch a unique gathering took place on August fourteen to nineteen, which was so much appreciated by those present, that it was suggested that it be made an annual meeting. At Niagara Falls in September the members of the Niagara Peninsula Branch surpassed themselves in the entertainment of their guests as well as in the splendid papers presented. At Halifax, on October thirteenth to fifteenth, the Maritime engineers had a gathering which for general interest both as to papers and other features was not surpassed by any during the year.

The Council desires to express its appreciation of the splendid co-operation received at all times from the Branches, and it is noted with satisfaction that all Branches of *The Institute* during the past year have made great progress, both in the numbers of their members and in developing a greater interest on the part of the individual member of the Branch in the profession.

Meetings

Professional meetings were held as follows:—

Annual and Professional Meeting, held at Montreal, January 27th, 28th and 29th, 1920, at which the following papers were read:—

"The Training of the Chemical Engineer," by R. F. Ruttan, M.A., M.D., D.Sc., F.R.S.

"The Importance of Physics in Engineering Education," by A. S. Eve, D.Sc., C.B.E., F.R.S.

"Quebec's Water Power Policy and the Work of the Quebec Streams Commission," by Olivier Lefebvre, B.A.Sc., C.E., M.E.I.C.

"The Operation of the Quebec Public Health Act," by Theo. J. Lafrenière, B.A.Sc., C.E., M.Sc., M.E.I.C.

"The Evolution of the Public Roads Problem in the Province," by Alex. Fraser, B.A.Sc., C.E., A.M.E.I.C.

"The Policy of the Air Board of Canada," by Lieut.-Col. O. M. Biggar, B.A., K.C.

"The Pulp and Paper Industry," by Ferd. van Bruyssel, C.E., D.P.S.

"The Forests of Quebec," by G. C. Piché, A.M.E.I.C.

Seventh General Professional Meeting held at Niagara Falls, Ontario, September 16th, 17th and 18th, 1920, at which the following papers were read:—

"The St. Lawrence Route and the Welland Ship Canal," by Alexander J. Grant, M.E.I.C.

"Design of the Queenston-Chippawa Power Canal," by T. H. Hogg, A.M.E.I.C.

"Hydraulic Installation of the Queenston-Chippawa Power Development," by M. V. Sauer, M.E.I.C.

"Electrical Features of the Queenston-Chippawa Power Development," by E. T. J. Brandon, A.M.E.I.C.

"General and Economic Features of the Queenston-Chippawa Power Development," by H. G. Acres, M.E.I.C.

Demonstration of the Gibson Method of Measuring the Flow of Water in Closed Conduits for Determining the Efficiency of Hydraulic Turbines, by N. R. Gibson.

Western Professional Meeting, held at Banff, Alberta, August 16th, 17th and 18th, 1920.

"Concrete in Alkali Soils and Waters," by A. S. Dawson, M.E.I.C.

"Legal Phases of Irrigation Development in Alberta," by H. B. Muckleston, M.E.I.C.

"Natural Resources of Saskatchewan," by R. W. E. Loucks, A.M.E.I.C.

"Railway Construction with the Royal Engineers in Palestine," by Lt.-Col. G. A. Walkem, M.E.I.C.

"Vancouver Harbour and Proposed Development," by Major W. G. Swan, D.S.O., M.E.I.C.

Eighth General Professional Meeting, held at Halifax, N.S., on October 13th, 14th and 15th, 1920, at which the following papers were read:

"The Development of the Steam Engine in the Maritime Provinces," by D. W. Robb, M.E.I.C.

"Electric Welding," by Fred. H. Williams, A.M.E.I.C.

"Practical Applications of Electric Welding," by F. P. Vaughan, M.E.I.C.

"Secondary Technical Education," by Prof. F. H. Sexton, D.Sc., L.L.D.

"The Development of the Sheet Harbour Water Power," by H. S. Johnson, A.M.E.I.C.

"The Progress of Hydro-Electric Development in New Brunswick," by C. O. Foss, M.E.I.C.

Roll of the Institute

Elections during the year resulted in the following additions to the Roll:—One Honorary Member; sixty-three Members; three hundred and twenty-eight Associate Members; one hundred and eighteen Juniors; three hundred and sixteen Students and ten Associates.

The following transfers were made:—fifty-four Associate Members to the class of Member; two Juniors to the class of Member; sixty-eight Juniors and twenty-nine Students to the class of Associate Member; forty-three Students to the class of Junior.

The following is a detailed statement of elections and transfers which have taken place. These are included in the official membership roll as acceptances are received and have been published monthly in *The Journal* immediately after election:—

Elections.

Month	Hon. Member	Members	Associate Members	Juniors	Students	Associates
January....		4	27	12	42	
February...					31	
March.....		9	29	10		1
April.......		18	41	17	17	1
May.......		11	67	18	5	2
June.......		1	22	8	9	1
July.......		3	19	7	6	1
August.....		2	32	6	3	2
September..		3	18	3	2	
October....		5	12	6	20	
November..	1	3	24	11	92	
December..		4	37	20	89	2
	—	—	—	—	—	—
	1	63	328	118	316	10

Transfers.

	A.M. to M.	Jr. to M.	S. to M.	Jr. to A.M.	S. to A.M.	S. to Jr.
January.... .	5			2	1	5
February..... .						
March........ .	6			9	6	6
April...........	8	1		11	2	8
May...........	7			11	4	6
June...........	4			8	1	1
July...........	6			5	1	2
August.........	5			5	5	4
September......	2			1	1	
October........	4			1	2	1
November......	4			10	4	6
December......	3	1		5	2	4
	—	—		—	—	—
	54	2		68	29	43

Removals from Roll

There have been removed from the rolls by resignation or on account of non-payment of dues: — twenty-four Members; one hundred and sixty-six Associate Members; two juniors; five Students and one Associate. A detailed list of resignations accepted is as follows:—

Members.............	Ashcroft, Albert E.
	Balloch, Guy R.
	Bagshawe, F. T.
	Brown, W. G. B.
	Elliss, H. D.
	Weatherbe, Paul
Associate Members.....	DesRosiers, Louis A.
	Dowson, E. C. H.
	Dulieux, P. E., Prof.
	Gostwyck, G. H. G.
	Hamel, E. A.
	Noble, C. W.
	Waterous, Logan M.
Juniors................	Adsett, F. C.
	Pook, R. A.
Students...............	Byron, M. R.
	De Cew, L.
	Mouquin, H. Jr.
Associate.............	Grunsky, H. W.

Deceased Members

The following deaths, forty-one in number, have been reported, of which number six were killed in action:

Honorary Member......	Ellis, W. Hodgson, M.A., M.B., LL.D.
Members.............	Blackwell, Kenneth William
	Canavan, Harold Worsley E.
	Duff, William Archibald
	Gwillim, John C., Prof.
	Henderson, Ernest G.
	Hertzberg, Anton Lund.
	Hodge, Col. Henry W.
	Jones, Thos. H.
	Kyle, David
	McKay, Owen
	Miles, Charles LeBaron
	Munro, G. Reid
	Wilmot, Edward Ashley
Associate Members.....	Baker, Hugh C.
	Bookhout, Alden F.
	Button, Stanley A.
	Cameron, Capt. O. L.
	Gingras, E. P.
	Glover, Lieut. Frank W.
	Mansity, Henry S.
	O'Hanley, John Mitchell
	Schenk, Thos. M.
	Scott, Peter
	Williams, Gerald C.
Juniors................	Buck, Lieut. Cameron A.
	Evans, Lieut. C. T.
	Macdonald. Lieut. John
	Middleton, James R.
	Osler, Charles E.
	Sneath, Thomas D.
Students...............	Galbraith, Major R. D., M.C.
	Racine, A.
	Rankin, Flight-Lieut. F. S.
	Richardson, S. S.

Killed in action or died while on active service:—

Associate Members.....	Cameron, Capt. O. L.
	Mansity, Henry S.
Juniors................	Middleton. James R.
	Sneath, Thomas D.
Students...............	Racine, A.
	Richardson, S. S.

Total Membership

At present the membership stands as follows:—

Honorary Members.....................	10
Members	918
Associate Members.....................	1,953
Juniors..................................	413
Students	719
Associates	36
	4 049
Elected—acceptances pending...........	124
	4,173

R. A. Ross,
President.

Fraser S. Keith,
Secretary.

Finance Committee

The President and Council,

In submitting the financial statement your committee is gratified to be able to call attention to the surplus of revenue over expenditure for the past year. This agreeable change in our circumstances is almost entirely due to the successful results shown by *The Journal* of *The Institute*, which has realized a profit of approximately fifty-four hundred dollars during the past twelve months, and is also due to the large increase in the current membership fees caused by the gratifying increase in the activities of *The Institute.*

While the result is satisfactory, and it is hoped that the publication of *The Journal* will continue to show some profit, it should be noted that almost the entire surplus of revenue came from this source, and that apart from *The Journal*, the operations of *The Institute* as a whole, the expenses and revenues practically balance.

Respectfully submitted,

H. H. Vaughan,
Chairman.

STATEMENT OF ASSETS AND LIABILITIES AS AT 31st DECEMBER, 1920

Assets.

PROPERTY ACCOUNT		$89,041.64
FURNITURE:		
Balance as at 1st Jan. 1920	$3,193.02	
Added during year	140.25	
	$3,333.27	
Less 10% written off for Depreciation	333.32	
		2,999.95
LIBRARY:		
Estimated value of Books		6,330.00
INVESTMENTS, including Special Funds:		
Canada Permanent Mortgage Corporation Stock, 18 shares Par Value, $10.00 each	$ 180.00	
Montreal Light, Heat & Power Co. Stock, 6 shares Par Value, $100.00 each	120.50	
Dominion of Canada Victory Loan Bonds, 1927, $500.00 Par Value	500.00	
Dominion of Canada Victory Loan Bonds, 1934, $1500.00 Par Value	1,500.00	
		2,300.50
ARREARS OF FEES — Estimated		2,500.00
ACCOUNTS RECEIVABLE:		
Advertising in Journal	$5,777.10	
Advances to Branches	450.00	
Sundry	14.95	
		6,242.05
GOLD MEDAL		45.00
CASH:		
Savings Bank Account	$728.96	
Canadian Bank of Commerce, Current Account	1,094.80	
Petty Cash on Hand	61.20	
		1,884.96
INSURANCE UNEXPIRED		193.83
STATIONERY ON HAND — Estimated Value		500.00
		$112,037.93

Liabilities.

SPECIAL FUNDS:			
Prize Fund Account		$468.77	
Leonard Medal		555.00	
Plummer Medal		560.00	
Fund in Aid of Members and Families		1,698.02	
			3,281.79
MORTGAGE ON PROPERTY:			
Royal Institute for the Advancement of Learning		$20,000.00	
Interest accrued thereon to date		233.33	
			20,233.33
ACCOUNTS PAYABLE:			
Printing		$4,683.11	
Branches, Rebates, etc		1,197.62	
General		449.96	
			6,330.69
CANADIAN BANK OF COMMERCE LOAN			1,750.00
SURPLUS ACCOUNT:			
Balance as at 31st Dec., 1919		$77,389.74	
Less:			
Written off arrears of Fees	$2,500.00		
Interest due for past years to Special Funds	188.03		
Written off Accounts Receivable	421.01		
		3,109.04	
		$74.280.70	
Add:			
Surplus for year to 31st Dec., 1920		6,161.42	
			80,442.12
			$112,037.93

Montreal, 12th January, 1921.
Verified: RIDDELL, STEAD, GRAHAM & HUTCHISON, C.A.,
Auditors.

STATEMENT OF REVENUE AND EXPENDITURE FOR THE YEAR ENDED 31st DECEMBER, 1920

Revenue.

SUBSCRIPTIONS:		
Arrears of Fees	$ 4,797.87	
Current Fees	21,584.70	
Advance Fees	916.48	
Entrance Fees	9,333.50	
		36,632.55
INTEREST:		
On Overdue Fees		292.98
DIVIDENDS:		
Canada Permanent Mortgage Corporation Stock	$18.00	
Montreal Light, Heat & Power Co. Stock	30.00	
		48.00
JOURNAL:		
Subscriptions and Advertising		28,129.31
YEAR BOOK ADVERTISING		639.13
BANK EXCHANGE		358.18
RENT OF HALL		40.00
BADGES		77.70
		$66,217.85

Expenditure.

BUILDING EXPENSES:		
Interest on Mortgage	$1,366.66	
Taxes	1,376.18	
Water Rates	203.70	
Fuel	773.74	
Insurance	36.39	
Light and Gas	141.64	
Caretaker's Wages and Service	1,029.40	
Repairs and Expense	710.32	
		5,638.03
OFFICE EXPENSE:		
Salaries, Secretary and Office Staff	$13,893.97	
Office Supplies and Stationery	1,936.85	
Postage and Telegrams	1,577.96	
Auditors' Fees	400.00	
Telephone	119.61	
Messengers and Express	48.73	
Miscellaneous Expense	188.80	
Legal Expense	17.40	
		18,183.32
PUBLICATIONS:		
Transactions	$ 3,662.30	
Postage on Transactions	146.50	
Journal Expenses	25,125.21	
		28,934.01
GENERAL EXPENSES:		
Annual and Professional Meetings	$537.17	
Special Conference	177.50	
Donation, C.E.S.A.	200.00	
Travelling Expenses, Secretary	895.00	
Branch Stationery and Expense	172.31	
Interest on Bank Loan	176.64	
Examination Fees	36.00	
Certificates	44.75	
Gzowski Medal	33.03	
Magazine and Library Expenses	198.93	
10% written off Furniture for Depreciation	333.32	
		2,804.65
REBATES OF FEES TO BRANCH SOCIETIES:		
Toronto	$596.81	
Quebec	147.25	
Winnipeg	475.77	
Ottawa	535.01	
Vancouver	264.29	
Kingston	63.14	
Victoria	126.88	
Edmonton	62.62	
Calgary	170.20	
Saskatchewan	168.77	
Peterborough	63.00	
St. John	100.75	
Hamilton	113.25	
Halifax	145.87	
Sault Ste. Marie	44.50	
Niagara Peninsula	154.43	
Border Cities	79.00	
Montreal	1,179.63	
Moncton	5.25	
		4,496.42
		$60,056.43
BALANCE being Surplus of Revenue over Expenditure for the year ending 31st December, 1920		6,161.42
		$66,217.85

Montreal, 12th January, 1921.

Verified: RIDDELL, STEAD, GRAHAM & HUTCHISON, C.A.,
Auditors.

By-Laws Committee

The President and Council,

The Committee recommends the following changes of the By-Laws of *The Institute*:—

Section 3. Amend the last sentence to read:—"A Non-Corporate Member shall not be entitled to vote on Institute affairs, or to hold office as an officer of *The Institute*, or as Chairman or Vice Chairman of a Branch. He may be entitled to vote on Branch affairs or hold office in a Branch, other than as specified above, when so permitted by the By-Laws of the Branch."

Section 9. Amend second and third last words of paragraph 1 to read "thirty-three". The last sentence of paragraph 1: to read:—"He shall not remain in the class of Junior after he has attained the age of thirty-three years."

Section 10. Amend second and third last words to read "twenty-seven." The last sentence to read:—"He shall not remain in the class of Student after he has attained the age of twenty-seven years."

Section 12. Amend by the addition of the word "three" after thirty. The clause to read:—"The officers of *The Institute* shall be a President, four Vice-Presidents, and thirty-three Councillors."

Section 13. Amend by substituting "eleven" for "ten", third line, Paragraph to read, "The term of office of the President shall be one year; of the Vice-Presidents two years; and of the Councillors three years. Two Vice-Presidents and eleven Councillors, in addition to any required to fill vacancies, shall be elected annually."

Section 32. Expulsion and Discipline.

Section 32, last paragraph to be changed to read as follows:—"In case the Council on receiving a complaint in writing, shall be of the opinion that the conduct of any Corporate or Non-corporate should become the subject of enquiry, with the view to ascertain whether there are grounds for disciplining or expelling him; or in case twenty or more corporate members shall think fit to draw up and sign a request for such an enquiry regarding any Corporate or Non-corporate member on any ground whatever, and shall deliver the same to the Secretary to be laid before Council for consideration; the Council shall first notify, by registered mail, the member against whom the complaint is laid, setting forth the charges and by whom made, and naming a date not less than six weeks from the date of such notification, for the holding of an enquiry."

"If the defendant member decides that he desires to be present in person at the enquiry, and so advises Council in writing, or by telegram, sent to the Secretary within four weeks from date of mailing the notification from Council, the Council shall rename a day for the enquiry, not less than eight weeks from date of preliminary notification, and shall notify complainants and defendants by registered mail at least four weeks previous to new date set and shall request their presence at the enquiry. Should any complainant member, after receiving due notice, fail to appear at the enquiry without having previously given reason in writing or by telegram satisfactory to Council, the Council shall demand of such delinquent member in writing by registered mail, that he furnish the defendant member through Council, a written apology satisfactory to Council, or send in his resignation from *The Institute;* failing the doing so, the Council shall cause the name of such delinquent member to be erased from the register and thus expel him."

"On the final date set for an enquiry, the Council shall make such enquiry as they deem adequate, the complainant and defendant members, if present, being given full opportunity for deposition and examination. Should Council not find sufficient reasons for disciplining or expelling the said member, no record of the enquiry shall be made in the minutes; but, if Council, by a majority of at least four-fifths of those present at a meeting especially summoned for the purpose, and at which at least twelve members of the Council are present, does find good reason for expelling or otherwise disciplining the said member on the ground that he has been guilty of improper conduct, the Council shall cause the name of such person to be erased from the register and thus expel him from *The Institute;* or otherwise discipline him at their discretion. The Secretary shall forthwith notify the member of the decision of the Council and, should the member be expelled, the Council shall report such expulsion at the next Annual General Meeting."

"Should the complainant or defendant be a member of Council he shall not act as a Councillor in any matter affecting the enquiry."

"No verbal or anonymous complaint against any Corporate or Non-corporate member shall be considered or acted upon by Council."

Section 34. Annual Fees.

Amend Section 34 to read as follows:—

The Annual Fees payable by Residents shall be as follows:—

Members	$18.00
Associate Members	15.00
Juniors	10.00
Students	2.00
Associates	18.00

The Annual Fees payable by Branch Residents shall be as follows:—

Members	$15.00
Associate Members	13.00
Juniors	8.00
Students	2.00
Associates	18.00

The Annual Fees payable by Non-Residents shall be as follows:—

Members	$13.00
Associate Members	11.00
Juniors	6.00
Students	2.00
Associates	18.00

Honorary Members shall be exempt from Annual Fees.

Respectfully submitted,

ARTHUR SURVEYER,
Chairman.

Canadian National Committee of the International Electrotechnical Commission

The President and Council,

Your Committee desires to present the following report as to the activities of the International Electrotechnical Commission during the year 1920.

Your Committee met in Ottawa on May 3rd, and various matters of importance called to the attention of the Committee by London Headquarters were discussed.

The year 1920, being the centenary of the discovery of electromagnetism by H. C. Oersted, a communication received from the Danish Electrotechnical Committee that steps should be taken to secure international acceptation of the name "Oersted" as the name of an electromagnetic unit was brought up. The matter was placed before the various national committees, it being suggested that the unit chosen be the "Unit of Reluctance".

A. B. Lambe, A.M.E.I.C., who has acted as Secretary of the Canadian Committee for eight years, asked to be relieved of his duties, as his work in the Dominion Water Power Board and that of Secretary of the Electrical Sectional Committee of the Canadian Engineering Standards Association gave him little spare time for other secretarial work.

The resignation of Mr. Lambe was accepted by the members of the Committee with deep regret.

H. A. Dupré, A.M.E.I.C., of Ottawa, a member of the Committee, was appointed in his place.

Respectfully submitted,

L. A. Herdt, M.E.I.C.,
Chairman.

Library and House Committee

The President and Council,

Two important changes have been adopted during the past year at the Headquarters of *The Institute*, one in respect of the location of the staff, and the other, re-indexing of the books of the Library.

Owing to the increasing volume of work at Headquarters the room provided for the staff was found to be entirely inadequate. Your Committee proposed that the space in the rear of the main floor, then used for the Library, should be given over to a general office, and that the Library be located in the basement, which is spacious and above ground. Following the approval of these changes by Council, they were put into effect, and it is believed have greatly facilitated the work of the office staff.

Two years ago *The Institute* adopted the proposal of the American Society of Civil Engineers regarding cataloging technical books, a modification of the Dewey decimal system. At that time the books were re-indexed, but the change was not put into effect. In placing the books in their new quarters it was decided to bring this change into effect and this has been carried out. In this system the following numerical classification is used:—

000 to 099	is assigned to	general engineering
100 to 199	" "	civil engineering
200 to 299	" "	mechanical engineering
300 to 399	" "	electrical engineering
400 to 499	" "	mining engineering
500 to 599	" "	metallurgical engineering
600 to 699	" "	gas engineering
700 to 799	" "	chemical technology
800 to 899	" "	naval and military science
900 to 999	" "	other subjects, not engineering

For instance, any book on civil engineering must come in the "100" class, subclassification "110" includes all books on the structural branch of civil engineering. "112" narrows this down again to the theory of design and stresses and strains. The system may be carried to great lengths in minute subclassification, but this is not necessary in a library of moderate size. Inside each subclassification the books are arranged alphabetically; for instance, "The Elasticity and Resistance of Materials of Engineering" by Burr is "112 B 96".

In arranging the books according to the new catalogue system allowance was made for expansion in each section of about ten per cent, that is, it will be possible to increase the number of books in the bound section of the library to this extent without having to re-arrange. Beyond this it will be possible to increase the accomodation materially by building out shelves from the present shorter sections.

By the former cataloguing the list were under two headings; author and title. The new catalogue is considerably more comprehensive, as in addition to author and title card, each book is listed under its general subject. For instance the book mentioned above, "Elasticity and Resistance of Materials of Engineering" by Wm. Hubert Burr in addition to the title and the author card has two additional cards on which the book is listed under the general subjects of "Strength of Materials" and "Engineering Materials". This arrangement is particularly convenient for a technical library as the reader seldom looks for a particular book but for information on a given subject.

Your Committee recommended that an appropriation be set aside for new books, but inasmuch as the finances of *The Institute* would not permit of this being done during the past year, it is hoped that an allocation will be made during the coming year to provide for new books that may be necessary. The following is a list of publications received and presentations made to *The Institute* during the past year.

Publications Received

The following publications were presented to *The Institute* during the year:—

By John Blizard, M.E.I.C., Bulletion No. 27, Mines Branch.
"Results of forty-one steaming tests conducted at the fuel testing station, Ottawa."

By Robert H. Parsons, M.E.I.C.
"The Coal Consumption of Power Plants and Bonuses for Coal Saving" by Robert H. Parsons, M.E.I.C.

By R. B. Young, A.M.E.I.C.
"Some Theoretical Studies on Proportioning Concrete by the Method of Surface Area of Aggregate". Read before the American Society for Testing Materials.

By the Institution of Engineers and Shipbuilders in Scotland.
"Photo-elastic and Strain Measurements of the Effect of Circular Holes on the Distribution of Stress in Torsion Members." By Prof. E. G. Coker, D.Sc., K.C., Chakko M. Sc. and V. Satake, Univ. College, London.

By Paul A. Beique, A.M.E.I.C.
"Atmospheric Circulation and Radiation", by Frank H. Bigelow, M.A.

By R. A. C. Henry, A.M.E.I.C.
List of Valuation publications prepared by the Engineering Society of New York.

By R. J. Durley, M.E.I.C., Secretary Canadian Engineering Standards Association.
Index of British Engineering Standards Association Specifications Available.

By J. V. Davies, M.E.I.C.
Report of the New York State Bridge and Tunnel Commission, 1920.

By P. E. Jarman, A.M.E.I.C., city engineer, Westmount, Que.
By-laws of the City of Westmount concerning Building Construction."

By Ministry of Mines.
"Bassins houillers de la Colombie Britannique, No. 69 Geological Series. "Le Devonien du Sud-Ouest de l'Ontario", No. 34. Geological Series. "Une reconnaissance géologique entre Golden et Kamloops, C.B., le long du chemin de fer Canadien du Pacifique." "Rapport Sommaire de la Commission Géologique", 1912, 1915, 1916.

By the American Society of Mechanical Engineers.
"Engineering Index, 1919".

By Chas. Gleason Elliott, Mem., A.S.C.E., and John Wiley and Sons, Inc.

"Engineering for Land Drainage" by Chas. Gleason Elliott, published by John Wiley and Sons.

By the Institution of Civil Engineers (Great Britain).
First Report of the Committee on Deterioration of Structures in Sea-water.

By J. A. Nicholson, Registrar, McGill University.
List of McGill graduates.

By the Superintendent, Geodetic Survey of Canada.
Annual Report of the Geodetic Survey of Canada.

By John Wiley and Sons.
"Hydraulic Tables" by Williams and Hazen, published by John Wiley and Sons.

By the Canadian Engineering Standards Association.
"Standard Specifications for Steel Railway Bridges" published by the Canadian Engineering Standards Association.

By Walter E. Segsworth.
Re-training Canada's Disabled Soldiers. By Walter E. Segsworth, published by King's Printer, Ottawa.

By C. E. W. Dodwell, M.E.I.C.
"Righteousness versus Religion", by C. E. W. Dodwell, M.E.I.C.

By McGraw-Hill Publishing Company.
"Standardization of Mining Methods", by Chas A. Mitke, published by McGraw-Hill Company.

By C. E. W. Dodwell, M.E.I.C.
Signed photograph of the Prince of Wales.

By J. P. Lippincott Company.
"Industrial Oil Engineering" by J. R. Battle, published by Lippincott Company.

By J. Oliver Hogg, Jr.
Wage Tables by J. Oliver Hogg, Jr., published by J. Oliver Hogg, Jr. Kansas City, Mo.

By publishers of The Canadian Engineer.
2 bound volumes "Canadian Engineer", 1920.

The following magazines have been added to those already being received:—

By subscription:—
- American City
- Industrial Management
- Machinery

In exchange for *The Journal.*
- Journal the American Institute of Electrical Engineers.
- Journal of the Engineers Club of Philadelphia.
- Military Engineer.
- Professional Engineer (American Association of Engineers).
- Pulp and Paper Magazine.
- Radio Review.

A number of very interesting war trophies have been received. They are as follows:
From the Director of War Trophies, Ottawa.
A German machine gun, No. 2061.
From Major Wm. T. Wilson, D.S.O., M.C. (with bar), A.M.E.I.C.
Tank gun, Crossbow, Gun laying sight (German), Three shell cases, Paper knife made from shell case, Gas alarm hammer, Gas mask, Periscope (German), Exploder, Shell dressing, Canteen, Two fuse caps, Numerous maps, documents, etc.

Respectfully submitted,
Alex. Bertram,
Chairman.

Papers Committee

The President and Council,

The Papers Committee has endeavoured to obtain by correspondence and personal effort papers for *The Institute* during the past year, and has pleasure in stating that a number of very good papers have been presented at various Branches and several will undoubtedly be found worthy of preservation in the records.

The year just passed has been remarkable in many ways and construction has been much less than usual, nevertheless some excellent material has been produced. Your committee has also been able to help a number of the Branches in the matter of exchange of speakers and papers, and although this is somewhat beyond the scope of the Committee's work it has been a pleasure to have assisted the splendid efforts of the local Committees.

A further appeal to all Branch Secretaries has recently been sent out, asking them to submit to the Committee all good papers received locally during the current year, and asking for further efforts. *The Journal* and the Branch system is making the work of the Papers Committee easier than in the past, and the various local Papers and Meeting Committees are to be congratulated on their success.

Respectfully submitted,

FREDERICK B. BROWN,

Chairman.

Committee on Policy

The Annual Meeting of *The Institute* held at Headquarters in January 1920, endorsed the following recommendation contained in the first report of the officers of the Ontario Provincial Division,—

> "That a Special Committee on Development be constituted, to consider and report respecting,—(a) the technical activities; (b) the internal relations and local association; (c) the relation with other national societies and related organizations; (d) the relation of public affairs; of *The Engineering Institute of Canada.*"

At a special conference held at headquarters on April 13th, attended by fifteen Councillors, including seven from Ontario, the officers of the Ontario Provincial Division, and the Chairman of the Toronto Branch, the following resolution was carried unanimously,—

> "That whereas this conference of members of Council residing in Montreal and members of the Province of Ontario, has been called by the request of Council for the purpose of offering an opportunity for discussion of the policy to be pursued by *The Institute.*
>
> "Be it therefore resolved, that in addition to the Committee on Remuneration of Engineers already appointed by Council, a further Committee on Policy should be appointed, to prepare for the consideration of Council a statement of the policies and objects of *The Institute;* further that the Council authorize this Committee on Policy to include in its statement the Council's approval of the establishment by *The Institute* of rates of remuneration for its members, both by fee and by salary, which rates *The Institute* will endeavour to uphold."

At the regular meeting of Council on April 27th, the above resolution was carried unanimously and the following were appointed as a Committee of Council to constitute the Committee on Policy:—

J. B. Challies, M.E.I.C., Chairman; A. R. Decary, M.E.I.C., Quebec; Gen. C. H. Mitchell, M.E.I.C., Toronto; W. J. Francis, M.E.I.C., Montreal; K. H. Smith, M.E.I.C., Halifax; J. G. Sullivan, M.E.I.C., Winnipeg; A. E. Foreman, M.E.I.C., Vancouver; with power to add thereto, having regard to geographical location. Subsequently F. H. Peters, M.E.I.C., of Calgary, was added to the Committee.

To date it has been impossible for the Committee to have a plenary conference, but the Chairman has had an opportunity of conferring with most of its members individually. Following these individual conferences, it has been agreed,

> I. That the remarkably rapid development of *The Institute's* activities, both topically and territorially, since the adoption of the report of the Committee on Society affairs, has made it absolutely necessary that Council concentrate so much of its energies in meeting the immediate growing needs of *The Institute* that it has been unable to formulate a positive policy or programme for the general guidance of *The Institute.*
>
> II. That notwithstanding the absence of specific statements of general policy, Council has in specific instances, established precedents which make *The Institute* one of the most progressive and practical professional engineering bodies of the English-speaking world. In its initiatory support of such fundamentally important matters as the following, *The Institute* gives place to no other comparable organization:—
>
> 1.—Licensing and registration of engineers.
> 2.—Conservation of resources.
> 3.—Scientific and industrial research.
> 4.—Classification and compensation of engineers.
> 5.—Engineering education.
> 6.—Student activities.
> 7.—International and national co-operation between professional engineering bodies.
> 8.—Publicity.
> 9.—Engineering standards.
>
> III. That a cursory examination of the minutes of meetings of Council within recent years indicates that progressive and often pioneer action in the above and many other equally important matters to the engineering profession has been taken by *The Institute.* Such action has of necessity been consistent with the financial facilities of *The Institute.* If there has, in certain cases, been apparent hesitation or restriction on the part of Council in establishing new precedents anywhere, any time, the minutes indicate the cause to have been, invariably, lack of funds.
>
> IV. That *The Institute* as now constituted not only offers an efficient, economical, adaptable, acceptable and immediately available means for consolidating the engineering profession in Canada into one harmonious, homogenous, national body, but that it has by its accomplishments to date proven both its ability and its desire **to facilitate the acquirement and interchange of professional knowledge among its members, to promote their professional interests, to encourage original research, to develop and maintain high standards**

in the engineering profession, and to enhance the usefulness of the profession to the public.

V. That a careful analysis of the history and development of *The Institute* to date, and its field of usefulness in the Dominion undoubtedly indicate the necessity of the assertion of principles and the proclamation of policies in order that the various activities of *The Institute*, either through Council, Provincial Divisions, Branches or individual, may be consistent with a clear-cut, positive and progressive programme or plan.

The Committee therefore, with diffidence purposes with all the advice and assistance available, preparing recommendations for submission to Council respecting an appropriate policy for *The Institute*. To this end it has initiated three main concurrent activities.

(a) The review of those decisions of Council which affect matters of policy;

(b) The reception of the views of Provincial Divisions, of Branches and of individual members in matters of policy;

(c) The examination of cognate reports from engineering societies in England, Australia and the United States.

Item (a) involves careful research into the minutes of Council and into past records of *The Institute* and is being carried out under the immediate supervision of the general secretary in consultation from time to time with the Chairman of the Committee.

Item (b) involves the appointment by Divisions and Branches by means of special general meetings, of committees to have recorded the considered judgment of the various geographical areas in matters of policy.

Item (c) involves a study of the trend of organized engineering endeavour throughout the English-speaking world. Much valuable information is obtainable from the cognate activities of the mother of all British engineering organizations,—the Institution of Civil Engineers, as well as from other engineering institutes in Great Britain. The efforts of the engineers of Australia to consolidate their multifarious professional societies, and to obtain satisfactory status for the engineer in the Antipodes, is of peculiar interest. Probably the most pertinent, because of the reflex influence upon the profession in the Dominion, are the progressive reports made by special committees on Development of the Founder Societies of the United States. The influence which has led to the organization within recent months, of the Federated American Engineering Societies, is indicative of a movement which has gained tremendous momentum in the United States for better organization and broader objectives among professional engineers generally.

Satisfactory progress has already been made. The general secretary is rendering the Committee invaluable service in the research of Council meetings and *Institute* records. The Ontario Provincial Division and several branches, notably Toronto, Niagara Peninsula and Ottawa, have already submitted valuable recommendations and discussions. Much excellent matter of practical utility has been received from individual members of *The Institute*. A mass of information respecting the activities of other professional bodies in respect of policy and development has been obtained.

In conclusion, it is felt that the Committee on Policy must "make haste slowly" before it can submit any even preliminary recommendations on matter of policy to the Council. It therefore in January 1921, respectfully reports progress.

Respectfully submitted,

J. B. Challies,
Chairman.

Publications Committee

The President and Council,

The Publications Committee begs to submit the following report for the year 1920, covering papers appearing in *The Journal* from December 1919 to November 1920, both inclusive.

(a) It is recommended that the papers named below, and any discussion thereon, be printed in Transactions:—

President's Address....................R. W. Leonard
"Coal Briquetting and Conservation".....P. A. N. Seurot
"Cotton Rope for Power Transmission"...J. M. Alison
"St. Maurice River Regulation and Gouin Dam"......................O. Lefebvre

(b) A group of papers dealing in a general way with various features of the Queenston—Chippawa Power Development was presented by Messrs. Acres, Brandon, Hogg and Sauer at the General Professional Meeting held at Niagara, and promise was given of more detailed accounts of the economic and engineering problems involved in this great project. We recommend that the question of publication in Transactions be deferred until the completed papers are available.

(c) We wish to draw attention to the papers by Messrs. C. J. Mackenzie and A. S. Dawson dealing with the question of deterioration of concrete in alkali soils. These are in the nature of progress reports of work now being undertaken by a Committee of *The Institute* acting under the authority of Council, and we recommend that the question of publication in Transactions be deferred until the report of the committee is available. In the meantime *The Journal* will serve as the medium by which the results of the investigations may be made known.

(d) We recommend that a list of all papers appearing in *The Journal* be printed in Transactions, so that there may be available in one volume, a complete statement of all papers published by *The Institute*.

Respectfully submitted,

E. Brown,
Chairman.

Branch Reports

Victoria Branch

The President and Council,

The following report with observations on the work and status of the Branch for the year just completed is herewith presented.

The list of members resident within the radius of the Branch includes 82 names, being made up as follows, Members 30, Associate Members 40, Junior, Students 3 and Affiliates 8. Of these 13 have either retired or are away from Victoria, leaving 69 who could if they would take some part in the work of the Branch.

Admissions to the Branch and *Institute* are as follows:—Members 1, Associate members 2.

Transfers are two from the grade of Junior to that of Associate Member.

Two applications for admission and one for transfer are still not completed.

Despite the fairly large membership, the attendance at meetings is only fair and on an average only about 14 attend, or under 20%. On occasions when papers or lectures have been given the average has been less than 10 at each occasion which is not encouraging.

At a lunch held on December 3rd last, 26 attended, which is about the number one would expect to be present on most occasions.

It should be a point of professional honour for all members to take an interest in the proceedings at Branch meetings, to criticise and suggest means by which the membership of the branch may benefit.

A Committee has been appointed to consider the question of Salaries and Classification with a view of co-operating with the committee of *The Institute* dealing with the same matter.

During the year a Bill has passed the local Legislature to regulate the practice of Professional Engineering in British Columbia. Much is expected from this measure.

It is as well to remember that *The Engineering Institute of Canada*, through its Committee on Legislation, prepared the draft of the bill, which has passed here and in some other provinces, more or less as drawn up, and is being presented to other legislatures.

It is a mistaken idea to suppose that, now that British Columbia has a Professional Engineers Association formed by Act of Parliament, *The Institute* ceases to be useful. Even supposing that the legal association does do everything for its members which we hope it will do, isolated Provincial Associations cannot do anything for the profession at large in Canada, and it is only through *The Institute* that the work of improving the status of engineers throughout the Dominion can be co-ordinated. A national body is necessary as has been quite recently demonstrated by the amalgamation of various separate organizations throughout the United States.

Formation of local chapters of the American Societies would be the natural result following the dissolution of the Canadian Institute. No one can say that this would be desirable.

Balance Sheet 1st December 1919 to 1st December 1920

Balance in Bank 1st December, 1919	$139.10	
Cash in Hand	13.46	$152.56

Receipts:

Fees from 1st Dec. 1919 to 30 Nov. 1920	214.50	
Rebates from Engineering Inst. Montreal	98.32	
Interest on War Bond	5.50	
Donation to Socials	1.00	$319.32

Disbursements:

Rent of Room, 1st Dec. 1919 to 30th Nov. 1920		195.00	
Postage Stamps		18.67	
Stationery		33.73	
Stenography		6.00	
Technical papers		18.99	
Lectures		8.40	
Socials — General	41.45		
Public Works Engs.	15.20	56.65	
Baloptican		75.00	412.44

Excess of Disbursements over Receipts	93.12
Balance in hand	$ 59.44

Liquid Assests:

Victory Bond	$99.11
Bank Balance	8.52
Cash	50.92
	$158.55

E. Davis,
Treasurer.

The Books, vouchers and balance sheet have been examined and found correct.

Clement A. Cornwall,
K. M. Chadwick, *Auditors.*

Respectfully submitted,
H. M. Bigwood,
Secretary.

Vancouver Branch

The President and Council,

The Annual Report of the Vancouver Branch for the year 1920 is herewith respectfully submitted:—

The Branch Membership is as follows:—

Members	56
Associate Members	81
Juniors	8
Students	15
Associates	1
	161

The outstanding feature of the year was the passing of the British Columbia Engineering Profession Act. This was secured by the various engineering societies in the Province, through a joint engineers' committee, promoting a Private Bill, the expenses in connection with which were provided by subscription of the engineers of the Province. After considerable opposition and amendment the Act was finally passed in March 1920.

This Branch played a prominent part in the "Bill" stages. The Branch Chairman, Prof. E. G. Matheson, M.E.I.C., being Chairman of the Joint Committee, while the Hon. Secretary was R. Snodgrass, A.M.E.I.C., and the Hon. Treasurer, J. N. Anderson, A.M.E.I.C.

On the successful passing of the measure Prof. Matheson was appointed Provisional President of the Association of Professional Engineers of the Province of British Columbia, while the Branch was well represented on the Council.

The interest displayed by the Branch members in Legislation, and the amount of time and energy called for to bring this to a successful issue, interfered to some extent with the normal activities of the Branch, but now that the Act is on the statute books and the Professional Association now successfully launched, the members are showing a decided interest in the affairs of *The Institute.*

The following meetings were held during the year:—

5 Jan., B. C. "Town Planning Act" (proposed) A. G. Dalzell, A.M.E.I.C.

3 Feb., "Reclamation of Northerly Part of Pitts Meadows," H. M. Burwell, M.E.I.C.

2 Mar., "Sub-Aqueous Tunnelling," E. G. Matheson, M.E.I.C.

5 July, Discussion B. C. Engineering Profession Act.

16 Oct., Dinner—Lt.-Col. R. Leckie, D.S.O., Speaker.

23 Dec., General Business Meeting.

At this last meeting the Council for 1921 was elected and new Branch By-laws were approved.

There has been a considerable change in the membership during the year and a welcome increase in numbers. The Branch lost a valuable member in R. F. Hayward, M.E.I.C., who has gone to Chili.

The balance on hand amounts to $90.53.

Respectfully submitted,

Geo. A. Walkem,
Chairman.

J. N. Anderson,
Secretary-Treasurer.

Calgary Branch

The President and Council,

During the year 1920 there have been seven general meetings, ten meetings of the Executive Committee and one joint meeting of the Executive Committee and Special Committee on arrangements for the Western Professional Meeting at Banff.

The first general meeting was held in the Board of Trade rooms on January 2nd when Major H. B. Muckleston, M.E.I.C., gave a very interesting address on the work of the Railway Troups in France. After Major Muckleston's address, Capt. J. J. Hanna, A.M.E.I.C., gave an impromptu talk on tunnelling at Hill 60 and Capt. F. K. Beach, A.M.E.I.C., spoke more in detail about the work of the railway troups.

On March 11th, H. E. M. Kensit, M.E.I.C., of the Dominion Water Power Branch, Ottawa, gave a most interesting paper on "The Water Powers of the British Empire."

On April 9th, C. D. Howe gave an illustrated lecture on Terminal Elevators; this meeting was held at the Public Library and the public were invited.

The members of *The Institute* were invited to a meeting of the Board of Trade at which Mr. Dalzell gave an address on city Taxation.

On May 4th there was a general meeting of all engineers to discuss the formation of the Association of Professional Engineers of Alberta. After this general meeting a meeting of the Branch members present was held and the question as to whether there should be a 1920 Western Professional Meeting under the auspices of the Calgary Branch was discussed. A Committee was appointed to report on the feasibility and suitability of holding such a meeting.

On May 22nd this Committee reported at a general meeting and it was decided to hold a Western Professional Meeting at Banff in August.

On June 5th the Committee again reported to a general meeting of the Branch. As the parent Institute found that it was unable to support a Western Professional Meeting the Committee wished to be assured that it was still the desire of the Branch to hold the Meeting. It was decided to go ahead without the support of the parent Institute.

On November 12th the fifth and last general meeting was held. This took the form of a smoker. An excellent programme was prepared by a special committee and the members present had a very pleasant evening.

At the ten Executive meetings the regular business of the Branch was attended to, and in addition three main subjects of interest to the Branch members were discussed and acted upon, namely:—Legislation and the formation of Association of Professional Engineers of Alberta, the Western Professional Meeting, Classification and Compensation of Engineers. In the way of general business the resignation of our Secretary-Treasurer and Asst. Secretary should be mentioned.

M. H. Marshall, M.E.I.C., having requested to be relieved of his duties, J. J. Hanna, A.M.E.I.C., was appointed by the Executive Committee on December 22.

C. M. Arnold, M.E.I.C., who for over two years had most acceptably filed the position of Secretary-Treasurer, resigned on April 16th as he was leaving Calgary to accept an important position with Mr. Muckleston on the Lethbridge Northern Irrigation Project. On April 23rd the present incumbent was appointed by the Executive Committee.

Legislation and the Association of Professional Engineers of Alberta

Up to the time of the passing of the act the Executive Committee gave all possible assistance to the Special Committee of engineers who were working on the Bill. On December 29th, Lewis Stockett, Chairman of the Rocky Mountain Branch of the Canadian Mining Institute met the Committee and discussed the matter at length. At the same meeting the Executive Committee arranged to advance $100.00 to the Special Committee to cover expenses until other financial arrangements could be made. This sum was loaned from and later returned to the Branch funds. The organization of the Branch was placed at Mr. Peters' disposal in calling a general meeting of engineers which was held on May 4th to discuss the formation of the Association of the Professional Engineers of Alberta.

It is gratifying to the Branch that the Act had been passed and the Association formed although we had hoped for a more complete Act than the one which was finally passed. It is also gratifying that F. H. Peters, M.E.I.C., one of our members, has had his excellent work in this connection acknowledged by being made the first President of the Association.

Western Professional Meeting at Banff

While the credit for the successful meeting held at Banff in August lies with the Special Arrangements Committee, considerable preliminary work was necessary on the part of the Executive Committee and it was necessary to finance the undertaking temporarily as no money was taken in until the Meeting opened. One hundred and fifty dollars was advanced to and repaid by the Special Committee for this purpose. The Meeting was a financial success, some $443.00 over and above expenses being paid into the general funds (one bill for damages to borrowed supplies not yet rendered). In view of the fact that the parent Institute did not believe that a successful meeting could be prepared in the short time at the Branch's disposal it is most gratifying to know that the Western Professional Meeting was in every way a success.

Compensation and Classification of Engineers

This question first came before the Executive Committee on December 22nd, 1919, when a letter was received from the Toronto Branch reporting the action taken there. It was again before the Committee on April 16th, October 26th and November 30th. No definite action was taken until the last mentioned date when it was decided to bring it before the present meeting so that the views of the members on this most important question could be obtained. The American Association of Engineers, Engineering Council representing the various Engineering Societies of the United States, the parent Institute and the majority of the Branches have already acted on this matter. The Edmonton Branch is now considering this matter and has asked this Branch to send a representative to their meeting next week.

The parent society publication, *The Journal*, has offered to the Branches rebates on Branch News and personal items and also on new advertising obtained through the Branch. The Branch Secretary is handicapped in obtaining news and personals through not being in personal touch with all the various activities of the Branch members. He would appreciate the assistance of the members in this work so that the Calgary Branch may show up as a live organization in this paper which reaches the majority of Canadian engineers.

During the year 15 have joined *The Institute* and 3 have obtained transfer to a higher grade as follows:—

2 Members, 8 Associate Members, 2 Junior Members, 2 Student Members, 1 Associate of Institute, 1 Transfer from Associate Member to Member, 1 Transfer from Junior to Associate Member, 1 Transfer from Student to Associate Member.

The following applications have been received and are being dealt with:—

1 Member, 8 Associate Members, 3 Junior Members, 1 Transfer Junior to Associate Member.

There are on the Branch records of Membership:

27 Members, 48 Associate Members, 7 Junior Members, 5 Student Members, 2 Associates of The Institute, 9 Affiliates.

Total, 92, and 13 applications pending, making a total of 105.

A financial statement for the year is attached hereto.

Financial Statement for the year ending November 30th, 1920

Receipts:

Balance in Bank, December 1st, 1919	$140.71
Fees from Members	22.00
Rebates from Parent Institute	141.06
Rebates from Journal	5.69
Interest on Bank account	3.34
Interest on Victory Bond	16.50
Net Receipts from Banff Meeting	442.98
Total	$772.28

Expenditures:

Stationery, Printing and General Expense	146.81
Books and Magazines	5.25
Balance in Bank (less one cheque outstanding) December 1st, 1920	620.22
Total	$772.28

Assests:

Balance in Bank, (less one cheque outstanding)............	620.22
Three $100. Victory Bonds, 1927 issue, present value........	286.50
	$906.72

Liabilities:

A charge of unknown amount by the City of Calgary for breakage of equipment at Banff Meeting...............	

Respectfully submitted,
ARTHUR L. FORD,
Secretary-Treasurer.

Edmonton Branch

The President and Council,

The 1920 Annual Report, covering the activities of the Edmonton Branch is submitted herewith.

The Branch Membership is as follows:—

Members	8
Associate Members . .	35
Junior " . .	5
Student " . .	4
Associates	1
Total	53

Six general meetings and seven Executive meetings were held during the year. The early meetings were taken up principally with matters pertaining to the preparation of the Engineering Profession Act. The Act was assented to April 10th. 1920. Although it does not give us a closed profession in Alberta, yet it is generally felt that a good start has been made.

Two technical papers were read during the summer, one by Mr. Parsons, formerly superintendent of the City Power House, on the "Law of Coal and Steam Consumption in Power Plants", and the second on "Enstein's Relativity" by Dr. Boyle of the University of Alberta.

The Branch had a cash balance on hand, December 31st, with all accounts paid of, $22.94.

The Officers for the year were:—

Chairman, R. J. Gibb, M.E.I.C.,
Secretary-Treasurer, R. P. Graves, A.M.E.I.C.

Executive:

D. J. Carter, A.M.E.I.C.,
R. W. Jones, M.E.I.C.,
Hon. J. L. Coté, A.M.E.I.C.
Col. Geo. W. MacLeod, A.M.E.I.C.

At the last general meeting of the Branch, the following Officers were elected:—

Chairman, D. J. Carter, A.M.E.I.C.,
Vice-Chairman, A. W. Haddow, A.M.E.I.C.,
Secretary-Treasurer, C. C. Sutherland, A.M.E.I.C.

Executive:

R. W. Ross, A.M.E.I.C.,
J. D. Robertson, A.M.E.I.C.,
E. Kells-Hall, A.M.E.I.C.,
Prof. R. S. L. Wilson, A.M.E.I.C.

Respectfully submitted,
D. J. CARTER,
Chairman,
C. C. SUTHERLAND,
Secretary-Treasurer.

Saskatchewan Branch

The President and Council,

The undersigned beg to submit the following report for the Saskatchewan Branch of *The Engineering Institute:*

During the past season, the regular activities of the Branch were carried on successfully. There were eight regular Branch meetings and nine meetings of the Branch Executive held, besides a number of meetings of the Legislation Committee, Concrete Committee, Salary Committee etc.

The question of Legislation occupied the attention of the members to a considerable extent. During the 1919-1920 session of the Provincial Parliament the Government was approached in this connection and the draft of our Act submitted. Several radical changes were suggested by the Government, to a few of which the Branch gave its consent. Eventually however an agreement on several important issues could not be reached and the professional Legislation was deferred until the fall session 1920, when it was taken up again by our Branch. The Provincial Government would not introduce the Act as a Government measure, but consented to bring it before the house as a Public Bill, reducing thereby the expense to the Branch considerably. The Act in its original form passed the second reading of the House, but was subsequently defeated in Committee, owing to considerable opposition having developed among the majority of members who seem to be opposed to all professional legislation. The Branch is considering at present what steps to take in order to insure the passing of the bill at the next session of the Provincial Parliament.

The custom of dinners preceeding all the regular meetings of the Branch has been retained, and the same are being held as heretofore every 2nd Thursday of the month at the Kitchener Hotel Regina.

A very successful Summer-Meeting was held at Saskatoon on July 15th at which a considerable number of our members had gathered. It was generally deplored that it was the first Summer-Meeting of our Branch at which our General Secretary could not be present. A goodly number of our members attended also the meeting of the Alberta Division at Banff.

The suggestion of our Branch to adopt sessional meetings in connection with the Annual Meeting of *The Institute* has been adopted and is being carried out.

Our Concrete Committee is continuing the investigations on the influence of Alkali Soils on Concrete and will likely submit a report to the Annual Meeting of *The Institute.*

Our Salary Committee prepared a very comprehensive schedule of salaries for engineers, which was forwarded to the Remuneration Committee of *The Institute*. A sub-Committee of same is at present working on a schedule of fees for engineers in private practice.

The following are some of the papers read at our regular meetings:

Prof. C. J. Mackenzie, M.E.I.C.: "Concrete Mixtures in Alkali Soil".

W. A. Begg, A.M.E.I.C.: "Interpretation of the Town Planning Act and Procedure in its Connection".

W. T. Thompson, M.E.I.C.: "The Hudson Bay Railway".

D. A. Smith, A.M.E.I.C.: "Mapping in War".

H. B. Sherman, A.M.E.I.C.: "Rural Automatic Telephones".

R. W. E. Loucks, A.M.E.I.C.: "Natural Resources of Saskatchewan".

C. W. Dill, M.E.I.C.: "Present and Future Development of Roadwork in Saskatchewan".

I. P. Roche, A.M.E.I.C.: "Construction of Carbonizing and Briquetting Plant near Bienfait, Sask."

A. J. McPherson, A.M.E.I.C.: "Materials for Waterpipes".

There has been a steady increase in the membership of the Branch, twenty-one new members being recorded, while ten members have left the jurisdiction of the Branch. There are, besides, twelve applications for admission to *The Institute* outstanding from our Province.

It has been found necessary to supplement again, by a Branch-assessment, the rebates received to an amount of $111.83 from the Parent Institute. The Branch assessment resulted in an increase of the assets of the Branch of $201.50, with a large portion of uncollected assessments. The expenditures for the year amounted to $312.75.

For the Executive of the Saskatchewan Branch.

Respectfully submitted,

W. R. WARREN,
Vice Chairman.

J. N. DE STEIN,
Secretary-Treasurer.

Winnipeg Branch

The President and Council,

On behalf of the Winnipeg Branch the following report for the year 1920 is submitted herewith. Our membership has increased from 269 to an active list of 295, being an increase of 9.66 per cent. The membership is distributed as follows:—

Members	51
Associate Members	168
Juniors	35
Students	16
Associates	1
Local Branch Affiliates . . .	24
Total	295

It is with regret that we have to record the death of one of our esteemed members and Past Chairman, W. A. Duff, M.E.I.C.

The Branch has been signally honoured by Council, in their action in conferring an Honorary Membership on our oldest and respected member, Brigadier General H. N. Ruttan.

The Branch has held 16 meetings during the year, as follows:—

Date 1920		*Subject*	*Speaker*	*Attendance*	*Remarks*
Jan.	2	"Mining and its Relation to Industrial Development"......................	W. J. Dick, M.E.I.C............	46	Regular
Jan.	21	"Some Considerations in the use of Powdered Fuels"............................	T. R. Deacon, M.E.I.C..........	56	"
Feb.	5	"Economics of Water Wheel Design"........	F. H. Martin..................	72	"
Feb.	18	"Concrete Mixtures in Alkali Soils"— (Paper by Prof. C. J. McKenzie, A.M.E.I.C., read by............................	B. S. McKenzie, M.E.I.C.........	56	"
Mar.	3	"Plans for Dealing with the Natural Resources of this Province......................	Capt. J. W. Wilton..............	39	"
Mar.	17	"A New Type of Internal Combustion Engine"...........................	Geo. R. Pratt, A.M.E.I.C........	43	"
April	1	"Safety Engineering".....................	A. MacNamara, A.E.I.C..........	56	"
April	21	"Some Observations on Electrical Distribution..................................	C. A. Clendenning, A.M.E.I.C....	37	"
May	6	Annual Meeting of the Branch............	....	28	Annual
Sept.	9	Report of Salary Committee...............	....	61	Special
Sept.	16	"Popular Government".....................	Hon. A. B. Hudson, K.C.........	51	Regular
Oct.	21	"Construction and Operation of Electric Furnaces"...........................	J. E. Davey....................	56	"
Nov.	5	"Electrical Transmission".................	Prof. J. W. Dorsey, A.M.E.I.C....	97	"
Nov.	18	"Manitoba's Right to its Natural Resources"	Prof. Chester Martin............	44	"
Dec.	2	Discussion, Direct Current Transmission....	Prof. J. W. Dorsey, A.M.E.I.C....	68	"
Dec.	16	"Some Principles of Ratemaking"..........	Geo. L. Guy, M.E.I.C...........	41	"

The average attendance during the year was 53, being an increase of 15 over the average for the previous year.

The members of the Branch, with the Engineering students of Manitoba University, held a very successful dance on April 7, in the Ft. Garry Hotel.

On June 3 the Branch tendered a complimentary luncheon to the visiting members of *The Engineering Institute of Canada,* who assembled to attend the Good Roads Convention. At the same time the Special Concrete Committee convened.

On October 12 the Branch tendered the Engineering students of Manitoba University a reception and smoker, which was well attended.

We are pleased to record having placed on the Statutes of the Province of Manitoba an Act Respecting the Engineering Profession, which became law on March 27, 1920.

Note should also be made of the very excellent work of the Salary Committee appointed by the Branch, the results of whose efforts have already been shown. The Civil Service Commissioner for the Province of Manitoba has recommended the acceptance of the classification of engineers as recommended by this Committee.

The Committee is still active, and using every influence to better the status of the engineers of the Province.

Financial Statement

Receipts from Local Dues collected during the year amounted to	$ 744.50
Rebates from the Main Society for the first three quarters	400.25
Rebates for Branch News	25.90
Interest, Earnings, Current Account, and Bonds	30.80
Association of Professional Engineers for stationery	15.00
Other Receipts, Smoker, Dance, etc. net	120.64
Total Receipts for the Year	$1,337.09
Bank Balance as at December 31, 1919	396.72
	$1,733.81
Total Expenditures	1,642.74
Bank Balance as at December 31, 1920	$ 91.07

Other Assets

Due from Main Society as at Dec. 31, 1920: —		
Rebates for last quarter	$ 73.39	
Rebates for Branch News	5.00	
Commission on advertising	53.75	
Local Dues in arrears from:		
Branch Members	99.00	
Local Affiliates	24.00	
Five $100 Dominion of Canada War Bonds — 1937	500.00	755.14
Total Assets excluding Office Equipment and Library		$ 846.21
Liabilities — Printing and Stationery		4.08
Assets over Liabilities, without consideration of Office Equipment and Library		$ 842 13

As our By-laws call for the Annual Meeting to be held in May, at which Officers are elected for the ensuing year, the present staff are continuing office until that date.

Respectfully submitted,
W. M. Scott,
Chairman.
George L. Guy,
Secretary-Treasurer.

Sault Ste. Marie Branch

The President and Council,

The Annual Report of the Sault Ste. Marie Branch of *The Engineering Institute of Canada* for the year 1920 is herewith respectfully submitted.

Membership

The Branch Membership at the close of the year was twenty-two, consisting of the following:—

Members	4
Associate Members	15
Junior Members	2
Students	1
Total	22

Eleven changes have taken place during the last twelve months due to various causes as follows:—

One Associate Member transferred to grade of Member;

One Member admitted to *Institute* in grade of Member;

Two Student Members joined Branch;

Two Associate Members left Branch;

Two Junior Members left Branch;

Three Student Members left Branch.

Finances

The finances of the Branch are in good condition, the Bank balance at December 31st. being $87.33.

Owing to the kindness of the Algoma Steel Corporation, their Board Room has been placed at the disposal of the Society for their meetings, thereby obviating any expense in this direction.

Meetings

During the year there were held nine regular meetings, at which papers were presented, and business carried out as follows:—

Jan. 29—"Economics of Mechanical Eng. by A. W. Sinnamon, M.E.I.C.

Feb. 26—"Forestry," by B. F. Avery.

Mar. 25—Elections for Branch Executive for 1920-21.

April 29—"Industrial Relations," by R. Olzendam.

May 27—"Economics of Mechanical Eng.," (second Paper), by A. W. Sinnamon, M.E.I.C.

June 24—Annual Meeting. "General Design of a Lock and Approaches," by J. W. LeB. Ross, M.E.I.C.

Oct. 26—"History of Engineering In and Around the Sault," by C. H. E. Rounthwaite, A.M.E.I.C.
Dec. 2—"Purchasing, and the Commercial Aspect of Engineering," by L. L. Jacobs, A.M.E.I.C.
Dec. 16—Discussion on Industry and Labor.

Executives Meetings were held on the following dates:—

January 23rd. 1920.
April 29th. 1920.
Oct. 26th. 1920.
Dec. 2nd. 1920.

Recently this Branch has innovated a system of advices, giving particulars regarding members of this Branch whose services are or will be available. A form, copy of which is attached, has been got out for this Branch and copies are mailed to the Secretary of every Branch.

Each member now receives one or more journals and brings to the notice of the meetings any items or articles of particular interest. The development of round table discussions has done much to increase the interest and improve the attendance of members.

Respectfully submitted,
GEO. H. KOHL,
Secretary-Treasurer.

ENGINEERING INSTITUTE OF CANADA

Branch at Sault Ste. Marie, Ontario.

....................192....

TO THE SECRETARY
............................BRANCH.

Be kind enough to bring to the notice of your members particulars concerning the under noted................ member, whose services are available.

..................*Secretary.*

Name........................ Age..........
Address...
Educational record.

Engineering Record.

Border Cities Branch

The President and Council,

The Executive of the Border Cities Branch beg to submit the following Annual Report for the current year ending December 31st, 1920.

Secretary's Report

Regular meetings held		8
Special " "		3
Average attendance		16
Outside speakers (papers)		4
" " (addresses)		5
Membership papers		4
Executive meetings		12
Present Membership		
Members	11	
Assoc. Members	32	
Juniors	8	
Students	2	
Total	53	

The Branch has had an active year and has been regularly represented at the meetings held by the Ontario Provincial Division, at the Annual Meeting of *The Institute* and at the Professional Meeting at Niagara Falls, Ontario.

Report of Membership Committee

The work of this Committee has included the receiving of applications for membership and looking up *Institute* Members who either have moved into this locality or had not been on our Branch roll.

This Committee has considered the question of Associates of *The Institute* and Affiliates of the Branch. It was the opinion that while there is some material for both these classes, efforts should be centered on active Membership.

We regret to report the loss by death of four of our Members, G. C. Williams, A.M.E.I.C., our first Secretary; E. G. Henderson, M.E.I.C., a member of long standing in *The Institute;* C. T. Evans, Jr.E.I.C., whose application had been passed only a short time before, and Owen McKay, M.E.I.C., who was known to many of us.

One Member, C. W. Tarr, and one Junior, R. Kendall, have moved from the jurisdiction of the Branch.

We have not attempted any special membership drive, owing chiefly to the scarcity of material. With the help of several active members we have been able to forward eleven applications, five of which have been passed to date.

The actual change in our membership list has been as follows:

Applications passed	5	5	
Applications now with Council	6		
Transfers	5		
New names added of men in District		12	17
Removed by death	4		
Moved from District	2		
Net gain in Membership			11

The Report of Advertising Commitee

Your Committee on Advertising having only recently been appointed, have to report that active steps are now being taken from which good results are anticipated.

Treasurer's Report

Receipts;

Balance at Annual Meeting, 1919		$54.58
Rebates received from headquarters during year		75.75
Special Branch fee subscribed by Members		80.00
Receipts from dinner Windsor Club (July)		37.75
Receipts Annual Dinner (Dec.)		54.00
Rebate due from headquarters to Dec. 31, 1920:		
Quarterly rebate	$15.75	
Branch News	6.67	
		22.42
Total		$324.50

Expenditures ;

Printing Notices, By-Laws, typeing, etc.	$26.93
Postage, express, etc.	10.89
Telegrams, telephones, etc.	9.03
Travelling expenses Branch Representative at Annual Meeting (Montreal)	42.50
Travelling expenses Branch Representative Ontario Provincial Division	55.29
Dinner expenses Windsor Club (July)	50.02
Miscellaneous	24.17
Expenses Annual Dinner (Dec.)	51.75
Total	$270.58
To Balance in Bank	31.50
To rebate due from headquarters to December 31st, 1920	22.42
Total	$324.50

Respectfully submitted,

H. B. R. Craig,
Chairman.

J. E. Porter,
Secretary-Treasurer.

Niagara Peninsula Branch

The President and Council,

The second annual report of the Niagara Peninsula Branch shows the year 1920 to have been one of substantial progress in technical, welfare and social affairs of the Branch.

The outstanding feature of the year was the Professional Meeting in September, which brought fame and pride to the Branch and set a new standard for gatherings of engineers.

The greatest event in Branch social affairs was the Annual Meeting in May, when a large attendance of members joined in a very happy dinner party at Niagara Falls. It was felt that the success of this function augured well for the Professional Meeting and it was on this occasion that the Branch learned to gauge the quality of enjoyment demanded for an engineering gathering, such as the Professional Meeting.

Nine meetings of the Branch and six Executive meetings were held during the year. Five speakers addressed the Branch on various technical subjects, the general secretary paid his annual visit in March, a dinner meeting was held in St. Catharine's in February and a trip of inspection was made to the paper mills at Thorold in October. In the same month the Executive Committee made a thorough study of questions of Remuneration and Institute Policy and outlined courses of progressive action on the two subjects which were later ratified by the Branch members and sent on to the respective committees of *The Institute* for furtherance by *The Institute* at large.

The two principle Branch Committees have been the Professional Meeting Committee and the Branch Legislation Committee.

The former was a large and well organized body which functioned perfectly. The latter is a small Committee of selected members, which has studied and analyzed the question of engineering legislation for the Province of Ontario and which presented a report to the Executive in December. This Committee is continuing to act for the Branch, during the present important stage of legislation in Ontario.

The healthy financial condition of the Branch has increased from 72 to 100 or 38% during the year. The membership stands as follows:—

Members	16
Associate Members	58
Juniors	11
Students	7
Associates	7
Affiliates	1
Total	100

Respectfully submitted,

W. P. Near,
Chairman.

Rex. Johnson,
Secretary-Treasurer.

Hamilton Branch

The President and Council,

This has been a banner year for the Hamilton Branch. The membership shows a good increase while the finances are in splendid shape. All the meetings have been well attended. The members of the Executive have all worked hard to stimulate interest in the affairs of the Branch. Most of the meetings held during the year have been reported in *The Journal* from time to time and therefore will only be mentioned in this report.

Jan. 24 — Luncheon at the Royal Connaught Hotel followed by a visit to the Coke Oven Plant of the Steel Company of Canada. A description of the plant, its equipment, operation and capacity was given to each member of the party. (See April number of *The Journal*—Branch News.)

Feb. 10 — A General Meeting of the Branch. Henry Harvie, A.M.E.I.C., of the Hydraulic Engineering Department of the Hydro-Electric Power Commission of Ontario read a paper on "The Extent and Value of Canadian Water Powers". His address was illustrated with numerous lantern slides. (See April number of *The Journal.*)

Mar. 2 — A General Meeting of the Branch. John Murphy, M.E.I.C., consulting electrical engineer of the Department of Railways, Ottawa, exhibited his moving pictures on needle and anchor ice formations to a large audience in the Canadian Westinghouse Auditorium. Pictures were also shown of the Panama Canal and Panama Pacific Exposition. (See April number of *The Journal.*)

Mar. 11 — This meeting took the form of a Dinner at the Royal Connaught Hotel. The speakers of the evening were R. K. Palmer, M.E.I.C., Chairman, Fraser S. Keith, A.M.E.I.C., general secretary and E. H. Darling, M.E.I.C., who read a paper on the "Necessity of an

Adequate Building Code". The nominating Committee to prepare ballot for election of officers was appointed at this meeting. (See April number of *The Journal.*)

April — Several Executive meetings held and routine business looked after. Ballot was issued for election of new officers returnable on May 22nd for the Annual Meeting.

May 22 — Annual Meeting. Reports of retiring Chairman and Secretary-Treasurer received and adopted. The Scrutineers announced the election of new officers for the ensuing year.

July 15 — First meeting of new Executive. Committees were appointed as follows:—

(a) Committee on Policy: R. K. Palmer, M.E.I.C., Chairman.

(b) Committee on Classification and Remuneration: E. H. Darling, M.E.I.C., Chairman.

(c) Papers Committee: H. B. Dwight, A.M.E.I.C., Chairman.

Oct. 12 — Membership Committee appointed—F. B. Paulin, A.M.E.I.C., Chairman. Routine business disposed of.

Oct. 26 — General Meeting of the Branch. Address given by Major A. C. Lewis, Secretary of the Canadian Deep Waterways Association on "The St. Lawrence River Project". The great international scheme whereby ocean going vessels can reach the Great Lakes. (See December number of *The Journal.*)

Nov. 17 — General Meeting of the Branch. Geo. Hogarth, M.E.I.C., chief engineer, Department Public Highways of Ontario gave an illustrated address on "The Public Highways of Ontario". (See December number of *The Journal.*)

Dec. 10 — Annual Dinner of Hamilton Branch held in Royal Connaught Hotel. Speakers: H. U. Hart, M.E.I.C., Chairman; Fraser S. Keith, A.M.E.I.C., general secretary and J. W. Tyrrell, M.E.I.C., who gave a splendid address on "The Hudson Bay Route". The address was illustrated with upwards of 100 lantern slides made from photos taken by the speaker. (See January number of *The Journal.*)

The Hamilton Branch deeply regrets to report the passing of our esteemed fellow member, T. Harry Jones, M.E.I.C., former city engineer of Brantford. Mr. Jones took an active interest in *The Institute* and assisted in the establishing of this Branch.

Membership of the Hamilton Branch on December 31st, 1920, was as follows:—

Members	14
Associate Members	42
Juniors	11
Students	19
Affiliates	48
Total	134

In addition to the above a large number of applications are now pending.

Finances :

Receipts ;

Bal. on hand at end of Branch year — May 30th, 1920, as per auditors report	$ 61.92
Total receipts May 30 to Dec. 31:	
Rebates — affiliate fees, etc.	213.78
	275.70

Expenditures ;

Total expenses May 30 to Dec. 31	77.34
Balance on hand	$198.36

Respectfully submitted,

H. U. Hart,
Chairman.

J. A. McFarlane,
Secretary-Treasurer.

Toronto Branch

The President and Council,

Herewith we beg to submit the Annual Report of the Toronto Branch.

The outstanding feature of the activities of the Toronto Branch during the calendar year of 1920, was the inauguration of weekly Branch meetings, which were started early in February and with the exception of the summer months were continued throughout the year, and have proven to be a decided success.

Altogether there were held during the year twenty-eight Branch meetings and eighteen Executive Committee meetings.

Most of the Branch meetings were devoted to lectures and discussions on various technical subjects, but some of them were taken up with receiving reports from Committees and with discussions of general business.

Through the various Committees which were appointed and active during the year, the Branch carried on numerous activities, tending to better the prestige of the profession in general, and to improve the status of the individual engineer.

The following Committees were active during the year: —

Publicity Committee

J. C. Krumm (Chairman), A. G. Young (Secretary-Treasurer), J. R. W. Ambrose, W. E. M. Bonn, P. Gillespie, T. D. Mylrae, R. O. Wynne-Roberts.

Committee on Ethics

T. D. Mylrae (Chairman), H. A. Goldman (Secretary), W. E. Douglas, H. T. Hazen, J. C. Krumm, H. J. Lamb, R. O. Wynne-Roberts, C. R. Young.

Zoning Committee

H. L. Seymour (Chairman), H. J. Caldwell (Secretary), G. G. Powell, A. E. K. Bunnell, J. P. Hynes, N. D. Wilson, Tracy LeMay, Wm. Storrie.

Policy Committee

E. T. Wilkie (Chairman), A. C. Oxley (Secretary), Wm. Storrie, H. A. Rhodes, P. Gillespie, W. J. Smithers, C. H. Mitchell, G. G. Powell, G. H. Power, C. R. Scott, T. Taylor, R. O. Wynne-Roberts — *ex officio*, H. A. Goldman — *ex officio*.

Membership Committee

J. M. Oxley, W. E. M. Bonn, H. J. Caldwell, C. D. Dean, F. B. Goedike (Chairman), E. A. Gibson, W. J. Smithers, Geo. Phelps, M. A. Stewart, A. E. Jupp, J. G. Jack, R. B. Young, E. M. Proctor, I. H. Nevitt, O. H. Shenstone, R. O. Wynne-Roberts, A. M. Reid, W. K. Scott.

Legislation Committee

Toronto Branch representative on the Advisory Conference Committee of the Ontario Provincial Division Willis Chipman.

Employment Secretary

R. T. G. Jack.

Committee on Social Service

T. L. Crossley (Chairman), J. H. Bradley, A. E. K. Bunnell, J. H. Curzon, G. Phelps.

Back Dues Committee

E. M. Proctor (Chairman), F. B. Goedike, R. T. G. Jack.

City of Toronto Building By-laws Committee

A. H. Harkness, P. Gillespie, G. T. Clark, F. G. Engholm, T. D. Mylrae, C. R. Young, J. B. Carswell, J. M. Oxley (Chairman).

Fees Committee

F. Barber, J. G. G. Kerry, E. A. James, Geo. Power, P. H. Mitchell, A. L. Mudge, R. E. W. Hagarty, F. M. Byam, C. R. Young, G. T. Black, Wm. Storrie, A. H. Harkness, R. O. Wynne-Roberts.

Library Committee

C. R. Young, L. M. Arkley, A. G. Young, A. L. Mudge, E. R. Clarke, H. J. Caldwell, W. B. Redman, A. B. Crealock, O. M. Falls, A. C. Oxley, (Chairman), P. W. Greene, H. R. Rhodes.

1921 Annual Meeting Committee.

General Committee

Col. H. J. Lamb, D.S.O. (Chairman), H. L. Seymour (Secretary), O. M. Falls (Asst. Secretary).

Sub-Committees

W. A. Bucke,	Chairman	Finance Committee.
Prof. T. R. Loudon,	"	Entertainment Committee.
G. A. McCarthy,	"	Technical Papers Committee.
J. R. W. Ambrose,	"	Publicity Committee.
J. B. Carswell,	"	Accommodation Committee.
Prof. H. E. T. Haultain,	"	Service Committee.
W. A. McLean,	"	Dinner Committee.
Geo. T. Clark,	"	Reception Committee.
Mrs. C. H. Mitchell,	Convener	Ladies Committee.

Sectional Meetings

R. O. Wynne-Roberts	Chairman	Municipal Engineering.
E. T. J. Brandon,	"	Electrical Engineering.
C. B. Hamilton,	"	Mechanical Engineering.
T. L. Crossley,	"	Chemical Engineering.
T. D. Mylrae,	"	Structural Engineering.

Members of General Committee

J. Roy Cockburn, E. L. Cousins, F. A. Dallyn, F. A. Gaby, Norman McLeod, Jas. Milne, P. H. Mitchell, E. M. Oliver, J. M. Oxley, G. G. Powell, Wm. Storrie, H. G. Acres, Willis Chipman, Peter Gillespie, A. H. Harkness, J. C. Krumm, Thos. Taylor, C. R. Young, Jas. McEvoy, W. E. Douglas.

Financial Statement

Income and Receipts during 1920		$448.26
Cash in Bank on January 1920		238.47
Rebates for Oct., Nov., Dec. 1920—Receivable		110.69
		$797.42
Expenditures during 1920	$529.62	
Bills payable	252.39	
	$782.01	
Surplus	15.41	
	$797.42	

Branch Membership

The exact number of the present membership of the Branch is not available, because so many members have recently been admitted to the Branch whose names have not yet been placed on our mailing list. It is fair to assume, however, that this membership is now in the neighborhood of five hundred.

As the Annual Meeting of the Branch for 1921 will not be held until April, the present officers remain in office until spring. These are as follows:—

Chairman, — R. O. Wynne-Roberts, M.E.I.C.
Vice-Chairman, — A. H. Harkness, M.E.I.C.
Secretary-Treasurer, — H. A. Goldman, A.M.E.I.C.
Executive Committee, — H. G. Acres, M.E.I.C.,
W. Chipman, M.E.I.C.,
Geo. T. Clark, A.M.E.I.C.,
J. C. Krumm, A.M.E.I.C..
T. Taylor, M.E.I.C.,
C. R. Young, M.E.I.C.

Respectfully submitted,

R. O. Wynne-Roberts,
Chairman.

H. A. Goldman,
Secretary-Treasurer.

Peterborough Branch

The President and Council,

The Executive Committee of the Peterborough Branch, begs to submit the following report for the year 1920.

Eleven meeting were held during the year a list of which follows.

Jan. 8th. — "Proposed Legislation for Engineers in the Province of Ontario." Discussion led by Jas. Mackintosh, M.E.I.C., Chairman of the local Committee on Legislation.

Jan. 24. — A continuation of the above subject.

Feb. 12th. — "The Economical Significance of Canada's Fire Waste." By J. Grove Smith, Dominion Fire Commissioner for the Department of Insurance at Ottawa. Illustrated with lantern slides and moving pictures.

Feb. 19th. — "Water Filtration." By R. L. Dobbin, M.E.I.C., Waterworks superintendent for the Peterborough Utilities Commission. Illustrated with lantern slides.

March 18th. — "Institute Affairs." By A. B. Lambe, A.M.E.I.C., of Ottawa, Secretary of the Ontario Provincial Division.

April 8th. — "Ice, Frazil and Anchor Ice." By John Murphy, M.E.I.C., of Ottawa, electrical engineer for the Department of Railways and Canals. Illustrated with lantern slides and moving pictures.

April 22nd. — "History and Development of Pulp and Paper Making." By P. P. Westbye, M.E.I.C., general manager, Wm. Hamilton Co., Peterborough. Illustrated with lantern slides and moving pictures.

May 6th. — Annual Meeting of the Branch, and election of Officers.

Oct. 14th. — "The Ontario Provincial Highway System." By the Hon. W. A. McLean, M.E.I.C., Deputy Minister of Highways for Ontario. Illustrated with lantern slides and moving pictures.

Nov. 11th. — Annual Banquet. Speakers: Julian C. Smith, M.E.I.C., F. B. Brown, M.E.I.C., R. O. Wynne-Roberts, M.E.I.C., and Alex. J. Grant, M.E.I.C.

Dec. 21st. — "Super Cement." Captain F. M. Dawson, A.M.E.I.C., of Toronto. Illustrated with lantern slides.

The attendance at these meetings was very good, averaging 42.

The membership of the Branch is as follows:—

Members	14
Associate Members	22
Juniors	13
Associates	1
Affiliates	30
Total	80

The Branch has taken an active interest in City affairs, and at the request of the City Council, appointed a Committee of its members who made an inspection of the foundation soil on the East side of the new Hunter Street bridge. The Committee was able to reassure the Council regarding the ability of the soil to support the load superimposed on it.

During the year the Branch suffered great loss in the death of two of its most prominent members, G. Reid Munro, M.E.I.C., and A. F. Bookhout, A.M.E.I.C. The former was Chairman of the Branch at the time of his decease.

The following is the financial statement for the year 1920:—

Receipts;

Balance in the Bank, Jan. 1st, 1920	$ 23.92
Grant from Council	49.85
Rebate from Fees	51.55
Rebate for Branch News	35.17
Affiliate Fees	100.00
Annual Dinner	170.00
Interest	0.62
	$431.11

Expenditures;

Rent and Fixtures	$ 27.50
Journal Subscriptions for Affiliates	50.00
Expenses of Annual Dinner	174.53
Printing	42.53
Flowers, etc.	38.50
Miscellaneous	45.74
Balance in Bank, Jan. 1st, 1921	52.31
	$431.11

Respectfully submitted,
R. H. PARSONS,
Chairman.
R. L. DOBBIN,
Secretary.

Kingston Branch

The President and Council,

The financial year of the Kingston Branch ends on the 31st of October, a statement issued on that date is attached.

Meetings were held on the first and third Tuesdays of each month during the University session. It was not found possible to secure a quorum during the long holiday as the members were scattered over the Dominion.

There has been no scarcity of technical papers contributed by engineers both inside and outside the Branch, and we have averaged an 80% attendance at all meetings, which we claim as a possible record.

This attendance is fostered by a close touch between all members and the Branch Executive, and the courtesy of the local papers in giving prominence to our meetings.

The members of the Programme Committee deserve a full measure of appreciation for their excellent work in getting together a programme that compares very well with the efforts of the larger Branches, and as our meetings are open to the Gentlemen Cadets of the R.M.C. and the Engineering students of Queen's University a lecturer is assured a satisfactory audience, and a very flattering attention.

During the year the Kingston Branch sustained a very great loss in the death of Professor J. C. Gwillim, M.E.I.C., whose place in the affection of the members can never be filled.

The membership stands approximately as follows:—

Members	7
Associate Members	11
Associates	1
Students and Juniors	20

Financial Statement year ending October 1st, 1920

Receipts:

Mar.	31	Cheque W. H. Slinn, retiring Sec.-Treas	$68.00
Apr.	16	E.I.C. Headquarters cheque advance	50.00
			$118.00

Expenditures,

Apr.	16	Railway fare, speaker chk. no. 2	12.00
Apr.	27	Stamps, chk. no. 3	2.00
Mar.	31	Entertainment, chk. no. 1	6.00
May	3	Printing and Stationery, chk. no. 4	8.40
			28.40
		Bank Balance Oct. 1, 1920	89.60
			$118.00

Respectfully submitted,

J. M. CAMPBELL,
Chairman.
W. P. WILGAR,
Secretary-Treasurer.

Ottawa Branch

The President and Council,

On behalf of the Managing Committee of the Ottawa Branch, we beg to submit the following report for the calendar year 1920:—

The Ottawa Branch of *The Institute* was formed in January 1909. The membership of the Branch is now exactly double what it was at the close of the first year.

Some changes have taken place in the personnel of the Managing Committee since the last annual meeting. Messrs, John Blizzard, M.E.I.C., and C. N. Monsarrat, M.E.I.C., resigned from the Managing Committee, the former on account of leaving the city and the latter on account of being out of the city most of his time. The vacancies were filled for the balance of the year by the appointment of Messrs. O. S. Finnie, M.E.I.C., and A. Ferguson, A.M.E.I.C. On account of increasing pressure of office and other work, M. F. Cochrane, A.M.E.I.C., felt compelled to resign as Secretary-Treasurer and in September the Managing Committee appointed F. C. C. Lynch, A.E.I.C., as Secretary for the balance of the year. During the past year the Branch had 6 luncheons, 7 evening meetings and 15 meetings of the Managing Committee. The statement of the Secretary-Treasurer shows a very satisfactory condition of the finances.

At the last annual meeting the advisability of the formation of a Professional Association of Civil Servants was discussed and the matter referred to the incoming committee. The Committee decided to take the initiative in calling together representatives of the various technical societies to discuss the question and appointed three delegates to represent the Ottawa Branch of *The Institute* at this meeting. As a result of the conference, the Professional Institute of Civil Servants was formed and today has a membership of over four hundred and fifty.

A special Committee on Remuneration was appointed. This Committee gave considerable thought to the subject and submitted a report which was forwarded to *The Institute's* general Committee on remuneration.

Many engineers are very much interested in the question of engineering legislation. Copies of a draft bill which it is proposed to submit to the Ontario legislature during the coming session were distributed to the members of the Branch, the Committee arranged for a mass meeting of professional engineers and invited Willis Chipman, M.E.I.C., of Toronto to address the meeting and explain the bill.

The "Removal of the Cross-Town Tracks" has been a public question in Ottawa during the past year. A joint meeting of the Ottawa Branches of *The Engineering Institute*, the Town Planning Institute and the Ontario Association of Architects was held and the following resolution passed:—

"Resolved that this meeting, without committing itself to endorsation of any definite details of method, desires to express general approval of the proposition for the removal of the Grand Trunk cross-town tracks and for the transfer of the handling of all through traffic in Ottawa to a line and yards established outside of the existing city limits."

The public memorial was later signed on behalf of the Ottawa Branch by the Chairman and the Secretary-Treasurer, who also formed part of the delegation which waited on the Minister of Railways and Canals.

The Committee sent a resolution to Council to the effect that as the taking over the Hydro-radials was distinctly an engineering project, the engineering profession should be represented on the Commission to be appointed by the Ontario Government to study the question and asked Council to make appropriate representations to the Drury Government. Our fellow member, A. F. Macallum, M.E.I.C., was appointed a member of this Commission.

A vacancy exists at the present time on the Railway Commission. It has been represented to Council that an engineer should be on the Commission.

The Committee have felt that an endeavour should be made to bring the engineering profession more to the knowledge of the public and as a means thereto the following resolution was passed:

"That the Proceedings Committee shall arrange each year for a popular lecture on an engineering subject of general interest to the public at large, and that this shall be called and advertised as 'The Annual Popular Lecture of *The Engineering Institute*, Ottawa Branch'. The subject of the annual popular lecture and the lecturer are to be approved by the Managing Committee before final arrangements are completed."

Our first popular lecture — "Canada's Ice Problems and their Solution" — by our fellow member, John Murphy, M.E.I.C., filled the Collegiate Hall and was a great success.

It was decided this year that the Councillors resident in Ottawa should constitute a Reception Sub-committee of the Branch, who would endeavour to see that new members and strangers should be welcomed to the meetings and made acquainted with the other members.

Three of our fellow members have had honours conferred upon them during the past year. The Order of the British Empire was conferred upon Lt.-Comm. Edwards, and Major Harcourt Emra. Commander Edwards is Superintendent of Radio Telegraphs in the Naval Service and this honour is conferred upon him as a recognition of the splendid service which he rendered during the war in keeping the Canadian radio service in a very high state of efficiency. Major Emra was technical adviser for civil engineering in 1918, to the Director of Engineering Works in connection with the British Government auxiliary shipbuilding programme, and afterwards Director of Extensions under the Ministry of Shipping, where he had full charge of the Department concerned with the technical and administrative work incidental to the increased output of ships and marine machinery, etc. W. J. Stewart, M.E.I.C., Chief Hydrographer of the Naval Service, was selected as one of two to represent the British Empire on the International Committee of Enquiry on the "freedom of transit" "international ports" and "international railways", in connection with the League of Nations.

During the past year A. P. Davis, President of the American Society of Civil Engineers had occasion to visit Ottawa on U.S. Government business. There was not time to call a Branch luncheon, but the Councillors, past Councillors and Managing Committee had the pleasure of having Mr. Davis with them at an informal luncheon and of hearing from him of the activities of the American Society.

On the 2nd December R. A. Ross, M.E.I.C., President of *The Institute* visited us at a regular luncheon and gave a very instructive review of the affairs of *The Institute.*

Proceedings

No Branch meetings were held prior to the Annual Meeting on the 8th January. Continuing the regular meetings from January 15th a good programme was arranged and the attendance at the different meetings was very gratifying, averaging 85 at the luncheon and 60 at the evening meetings. In the case of Mr. Boyd's paper on surveying, the attendance was 140. In spite of very bad weather conditions the attendance at the "Annual Popular Lecture", which was given by John Murphy, M.E.I.C., was over 500.

The following is a list of the meetings and luncheons during the year: –

Jan. 8—Annual Meeting, Board Room of the Commission of Conservation.

Jan. 15—"Bridges: Their Relation to Architecture and Town Planning" by Frank Barber, A.M.E.I.C., of Toronto; joint meeting with the "Town Planning Institute" and the "Ontario Association of Architects" held at the Carnegie Library.

Feb. 12—"Progress in Aviation" by J. A. Wilson, A.M.E.I.C., Secretary of the Air Board; luncheon held at the Chateau Laurier.

Feb. 26—"Development of the Motion Picture Industry" by B. E. Norrish, M.Sc., A.M.E.I.C., at the Publicity Bureau, Demonstration Room.

Mar. 4—"The Development of Canada's Mercantile Marine" by Alex. Johnston, Deputy Minister of Marine; luncheon at the Chateau Laurier.

Mar. 18—"Bituminous Sands of Northern Alberta" by S. C. Ells, B.A., B.Sc., mining engineer, Department of Mines; at the Carnegie Library.

April 1—"Eight months adrift on the ArcticIce" by Storker Storkersen, Arctic explorer; luncheon at the Chateau Laurier.

April 8—"Proposed Removal of the Grand Trunk Cross Town Tracks" by J. Noulan Cauchon, A.M.E.I.C.; joint meeting with the Town Planning Institute and Ontario Association of Architects; at the Carnegie Library.

April 21—Annual Popular Lecture—"Canada's Ice Problems and their Solution" by John Murphy, M.E.I.C., at the Collegiate Institute Hall.

May 5—A. P. Davis, President of the American Society of Civil Engineers; luncheon at the Chateau Laurier.

Nov. 6—"The Common Street Car" by A. B. Lambe, A.M.E.I.C., at the Hull Electric car sheds; luncheon at the Rivermead Golf Club.

Nov. 18—"The Conservation of Coal in Steam Boiler Furnaces" by J. S. Kingston, held at the Carnegie Library.

Dec. 2—"*The Engineering Institute*" by R. A. Ross; M.E.I.C., President of *The Institute*, luncheon at the Chateau Laurier.

Dec. 16—"The principles and methods of modern topographical surveying" by W. H. Boyd, B.A.Sc., M.E.I.C.; held at the Carnegie Library.

Membership

Two meetings of the Committee on Membership were held in April and May last and four meetings during the past fall.

Forty-five applications in all were dealt with:—

New Members	6
Associate Members	15
Juniors	4
Students	1
Transfers to Higher Grade	13

There were also eight removals and two resignations.

The following are comparative figures of the Branch Membership for 1918, 1919 and 1920:—

	1918	1919	1920
Honorary Members	..	1	1
Members	68	81	90
Associate Members	123	148	158
Associates	2	2	2
Juniors	33	31	32
Students	24	28	27
Branch Affiliates	28	24	24
	278	315	334

Rooms and Library

The Branch has no rooms at present and our furniture is stored in an unoccupied office. It was recently inspected and a portion of it will be disposed of in accordance with the desire of the Managing Committee. During the year the arrangement has been continued by which the library has been made available for the membership at the Motor Building. Considerable use has been made of the books and a good many requests for information dealt with. On account of the limited space available it is considered more desirable to advise members where information may be obtained, rather than to try and stock the books themselves. For this purpose lists of Dominion and Provincial publications are kept, also those issued by the British and the United States Governments. Abstracts of and references to papers on technical subjects are received from the American Society of Mechanical Engineers, the Institution of Civil Engineers, Engineering News Record and other sources. The library now contains about eight hundred volumes and during the year presentations have been received from R. de B. Corriveau, M.E.I.C., Col. C. N. Monsarrat, M.E.I.C., and C. D. Norton, M.E.I.C.

Last year it was suggested that the library be transferred to the Carnegie Library so as to make it more readily available. This was carefully considered and it was found that the books could not be kept there in separate cases as had been hoped, but would have to be indexed and kept along with the other books and would thus lose their identity as a separate collection. Many of the books have been presented by past leaders of the profession and possess a sentimental value on that account. It was therefore felt that it would be better to keep the library at it is at present, looking forward to the time when it may be placed in permanent quarters belonging to the Branch.

Publicity

It is considered that the interest of the engineer and *The Institute* would be best served if attention were paid to the following lines:—

1. To draw to the attention of all interested, whether members of *The Institute* or not, such papers, lectures or addresses as may be of interest.

This has been accomplished by the insertion of advance notices and editorials, through the courtesy of local papers, and by notices mailed to other professional men, and other professional bodies in advance of the meeting.

2. To obtain a correct and comprehensive report of meetings in the press.

This has been attained by inviting representatives of the press to be present, and by seeing that the import of the paper or address was made apparent to them.

3. To see that the public, through the press, were made aware of the important and leading place the professional engineer takes in the life of the community and the nation.

The press has shown itself to be receptive of such ideas as have been brought to its attention, by featuring in editorials and in its news columns the subject matter of papers and addresses, and the appointments of various engineers to important posts.

During the year the local press has carried an aggregate of 36 columns of 22 inches each, of reports of meetings, and 9 editorials have appeared, both local papers being equally courteous in opening their columns to this Branch of *The Institute*.

A commencement has been made towards advising engineers outside of Ottawa of our meetings. Notices of past and future meetings have been mailed to the engineering journals in Canada and in the United States, and it is hoped that visiting engineers will continue to find it possible to get in better touch with their confreres in Ottawa.

Policy

A Committee on Policy was appointed by Council to propose definite means by which the objects of *The Institute* can be carried out and the Chairman of that Committee asked for the co-operation of the Branches by the appointment of sub-committees which would consider the subject in a broad manner and submit their suggestions.

The Ottawa Branch appointed a sub-committee composed of the following past secretaries:—M. F. Cochrane, A.M.E.I.C., Convenor; J. B. Challies, M.E.I.C., A. B. Lambe, A.M.E.I.C. This Sub-Committee gave the matter considerable thought and study and prepared a comprehensive report which has been submitted to the General Committee.

Advertising in "The Journal"

A Committee on advertising in *The Journal* was appointed in September, 1920, and to date has secured two new contracts each for 12 months, the total cost of which was $390.00. Several other new contracts are anticipated in the near future.

Finances

The financial position of the Branch continues to be highly satisfactory, as may be seen by reference to the attached statements of assets and liabilities and of receipts and expenditures.

The principal assets of the Branch consist of eight hundred dollars ($800.00) in Victory Bonds and about four hundred and twenty-eight dollars ($428.00) in cash. The net income shows an increase over that for 1919, notwithstanding the fact that the net expenditure for purely branch purposes has been slightly increased.

Officers for 1921

The Annual Meeting of the Branch will be held in Ottawa on the 13th January when the officers and members of the Managing Committee will be elected for the year 1921.

Statement of Assets and Liabilities for the year ending December 31, 1920.

Assets

Furniture (Cost $200.00)	$ 80.00
Library:	
Book Cases (Cost $72.50)	50.00
Bound Magazines } Nominal	1.00
Books (800 volumes) } Nominal	25.00
Rebates due from Main Institute on 1920 Fees	72.13
Stationery and equipment	20.00
Victory Bond due December 1, 1922	500.00
Victory Bond due November 1, 1934	300.00
Cash in Bank	419.23
Cash on hand	8.27
	$1,475.63

Rebates item and cash balance O.K.
Victory Bonds produced.

(Sgd.) A. A. DION,
Auditor.

Liabilities

Surplus	$1,475.63
	$1,475.63

Receipts

Balance in Royal Bank, 1st January, 1920	$174.27
Cash on Hand	4.72
Rebates from Main Institute, quarter ending 31st Dec., 1919	69.64
Proceeds of Sale of Playing Cards	.50
Branch Affiliate Fees — arrears, 1918	2.00
" " " " 1919	4.00
" " " " 1920	32.00
A. B. Lambe, Refund of Postage Provincial Division	11.18
Rebates from Main Institute Jan. to Sept. 30, 1920	460.38
Interest on $500.00 Victory Bond year 1920	27.50
" " $300.00 " " " "	16.50
Proceeds of sale of luncheon tickets, 77 at 75c.	57.75
Branch News Journal, May and June 1920	5.56
	$866.00

Audited and found in accordance with Cash Book
(Sgd.) A. A. DION,
Auditor.

Expenditures

Postage, Envelopes and Exchange	$ 41.84
Printing	45.00
Luncheon expenses, Committee Meetings	18.20
Luncheon expenses, Branch Meetings	77.45
Telegrams and Telephones	2.91
Janitor service, Electrician and tips	13.00
Stenographic & Accounting Services, Secretary's Office	52.50
Refreshments Annual Meeting	6.00
James Wilson & Co., Framing Portrait	6.50
Luncheon — Daffodil Tea Room	12.00
C. P. Edwards — Expense of Annual Popular Lecture	7.00
Expense of luncheon for A. P. Davis	11.90
Luncheon — Executive Committee	2.35
Rivermead Golf Club — Luncheon	77.00
A. B. Lambe — Lecture Expenses	4.50
Complimentary Tickets for Luncheon	3.00
The Citizen	18.00
Insurance	2.00
Engineering News Record	16.32
Engineering Index	4.50
Book Case for Library	12.50
Cartage of Lantern to meetings	4.00
Balance in Bank, 31st Dec., 1920	419.23
" Cash on hand	8.27
	$866.00

Respectfully submitted,
G. B. DODGE,
Chairman.
F. C. C. LYNCH,
Secretary-Treasurer.

Montreal Branch

The President and Council,

General

The Branch year extends from June 1st to May 31st, and it therefore follows that the period covered by this report refers to part of two Branch years, and covers the activities controlled by two seperate Executive Committees, the personel of which is given below.

1919-20		*1920-21*
Walter J. Francis,	Chairman,	Arthur Surveyer,
Arthur Surveyer,	Vice-Chairman,	Jas. H. Hunter,
Frederick B. Brown,	Secretary-Treas.	J. L. Busfield,
H. G. Hunter,		K. B. Thornton,
F. P. Shearwood,		J. Duchastel,
W. Chase Thomson,		S. F. Rutherford,
K. B. Thornton,		G. R. MacLeod,
J. Duchastel,		John T. Farmer,
S. F. Rutherford,		O. O. Lefebvre,
	(*ex officio*)	Walter J. Francis.

There are four sections of the Branch, namely:—

	Chairmen 1919-20	1920-21
Civil	O. O. Lefebvre	O. O. Lefebvre
Mechanical	F. Newell	John T. Farmer
Electrical	J. A. Burnett	G. K. McDougall
Industrial	S. F. Rutherford	S. F. Rutherford.

Reception Committees under the Chairmanship of J. L. Busfield and Geo. R. MacLeod for the two years respectively have continuously looked after their regular duties at the meetings.

Membership

Although no extraordinary steps have been taken to increase the Branch Membership there has been a steady and gratifying increase. Credit must be given to those members of the Branch connected with McGill University who have done so much to encourage the students to attend our meetings and to become members of *The Institute.*

Branch Membership

	Jany. 1st, 1920	Dec. 31st, 1920
Honorary Members..........	3	3
Members..................	126	150
Associate Members..........	260	308
Juniors..................	42	59
Students..................	138	184
Associates..................	8	11
Branch Affiliates...........	3	12
Totals................	580	727

The Executive Committee has discussed the advisability of appointing a membership committee, in all probability this will be done early next year, and it is hoped that there will be a larger increase of membership before the end of the coming year. It is felt that our meetings have been attractive and varied enough to appeal to all branches of the profession.

Annual and Professional Meeting

The most important event during the past year was the sixth General Professional Meeting held under the auspices of the Montreal Branch, in conjunction with the Annual Meeting of *The Institute,* on January 27th, 28th and 29th. The outstanding feature of the Meeting was the great interest displayed and consequent large attendance not only of local members, but of visiting members and guests from all over the continent. The following figures give the recorded attendance:—

Montreal members............	349
Visiting members..............	154
Guests........................	148
	651
Ladies at social functions.......	186
	837

On the morning of January 28th, "The Gateway of the Profession" was discussed by Professors R. F. Ruttan and A. S. Eve, followed by Brig.-Gen. C. H. Mitchell, Dr. F. D. Adams, Arthur Surveyer and Professor Chas. F. Scott.

The members of *The Institute* were entertained at luncheon by the Northern Electric Company, followed by a visit through the extensive plant.

The Annual Banquet was held at the Windsor Hotel on the evening of January 28th, with an attendance of over two hundred, including many prominent guests. Speeches were made by Brig.-Gen. Mitchell, Hon. Chas. Marcil, Lt.-Col. R. W. Leonard, Professor Chas. F. Scott, R. A. Ross, Judge Surveyer and B. K. Sandwell.

During the morning and afternoon sessions on January 29th, the following papers were presented:—

"Quebec's Water Power Policy and the Work of the Quebec Streams Commission," O. O. Lefebvre, M.E.I.C.

"The Operation of the Quebec Public Health Act," T. J. Lafrenière.

"The Evolution of the Public Roads Problem in the Province," Alex. Fraser, A.M.E.I.C.

"The Policy of the Air Board of Canada," Lt.-Col. O. M. Biggar.

"The Pulp and Paper Industry," Ferd. Van Bruyssel.

"The Forests of Quebec," G. C. Piche, A.M.E.I.C.

The convention closed on January 29th, with the annual smoking concert held in the Rose Room of the Windsor Hotel.

Regular Meetings

The policy of holding meetings "Every Thursday Evening at Eight-Fifteen" has been continued with very gratifying results. The Papers and Meetings Committees, under the Chairmanship of John T. Farmer, 1919-20, and J. A. Burnett, 1920-21, have done excellent work in obtaining a variety of papers, many of which have been of great technical value, while others have been of more general and public interest. On the latter occasions the opportunity has been taken to invite prominent citizens to the meeting.

The table on the following page gives the complete list of regular meetings held during 1920, with the subjects, authors and attendance. In most cases the attendance figures quoted are somewhat low owing to the fact that there are always some members and guests who fail to sign the attendance card. It will be noticed however, that the attendance has steadily increased, and in greater proportion than the increase of membership, indicating that there is a keener interest in the Branch meetings. In this connection the Executive Committee of the Montreal Branch desire to draw the attention of Council to the almost urgent necessity of providing larger seating accomodation in the hall. On a number of occasions during the past year additional chairs have had to be rented at exhorbitant rates, and at practically every meeting during the past few months there has been standing room only. The Executive Committee has even refrained from taking active steps to increase the attendance owing to the lack of accomodation.

Regular Meetings of the Montreal Branch, 1920

Date		*Subject*	*Author*	*Attendance*
Feb.	12	*Ice Formation	John Murphy, M.E.I.C.	150
"	19	Aerial Photography in the War	Lieut. C. C. Brooks, M.C.	70
"	26	Electric Motors	N. C. Mills	65
Mar.	4	Industrial Relations	J. S. Cameron, A.M.E.I.C.	60
"	11	Inundation Work with the B.E.F.	Lieut. G. L. Shanks, A.M.E.I.C.	50
"	18	*Utilization of Lignite	R. deL. French, M.E.I.C.	90
"	25	Re-Planning Montreal and District	Jas. Ewing, M.E.I.C.	80
Apr.	1	Naval Gunnery	Lord Congleton, Jr.E.I.C.	95
"	8	Hydration of Cement	F. M. Dawson, A.M.E.I.C.	65
"	15	*The Regulation of the St. Maurice River	O. O. Lefebvre, M.E.I.C.	90
"	22	Cotton Rope for Power Transmission	J. M. Alison	50
"	29	ˣEngineering Features of Tramway Operation	D. E. Blair, A.M.E.I.C.	110
May	27	Annual Meeting.		
Oct.	14	Some Problems of a Consulting Engineer	T. K. Thomson, M.E.I.C.	160
"	21	*Pipe Casting by the Centrifugal Process	A. F. Macallum, M.E.I.C.	125
"	28	*Miscellaneous Motion Pictures		265
Nov.	4	Modern Superheater Practice	H. B. Oatley	120
"	11	Commercial Air Service in Canada	R. B. Daville	80
"	18	Heating and Ventilation of Paper Machine Rooms	E. A. Ryan, A.M.E.I.C.	130
"	25	Some Economic Aspects of Canadian Forest Resources	R. O. Sweezey, M.E.I.C.	80
Dec.	2	The St. Francis River Water Storage	A. Duperron, A.M.E.I.C.	120
"	9	*The Exploitation of Spitsbergen	J. Maxtone-Graham	150
"	16	*Overall Thermal Efficiency in Everyday Engineering Practice	G. P. Cole, M.E.I.C.	140

*Motion Pictures were shown at these meetings.

ˣAt this meeting presentation was made of the Gzowski medal and also of a number of badges to Honorary Members.

The average attendance during the months of October, November and December is 70% greater than during the months of February, March and April. The membership of the Montreal Branch increased 25% from the beginning to the end of the year.

Publicity

Attention has been given to the obtaining of proper publicity for the activities of the Branch, and during the past season the *Montreal Gazette* in particular has devoted considerable space to our papers and discussions, with well-displayed headlines.

Finances

During the past year the finances of the Branch have been handled in different ways. During the first half of the year, petty expenses were paid by the Branch out of the balance of a grant made by Council in 1919, while the main expenses were paid by *The Institute* and later debitted against the Branch. During the latter half of the year the Branch has handled its own financial affairs entirely.

The following statements give the total receipts and expenditures for the year 1920.

Receipts :

Balance on hand, January 1st, 1920	$ 89.48
Balance from Annual Professional Meeting	37.43
Rebates — January, February and March	556.75
" April, May and June	283.50
" July, August and September	205.13
" October, November and December	137.36
Dues from Branch Affiliates	25.00
Payments for Branch News, to September	28.21
" " " " to December	6.67
Total	$1.369.53

Expenditures :

Paid by Institute for Branch, previous to June, 1920	$ 494.38
Petty expenses, previous to June, 1920	63.23
Secretary's Honorarium	150.00
Clerical Assistance	65.00
Telephone	40.77
Post card notices	121.50
Miscellaneous printing	72.16
Stationery	15.45
Moving pictures, lantern slides, etc.	106.12
Publicity	17.50
Miscellaneous, Signs, Chairs, etc	34.31
Total	$1,180.42
Balance on hand, January 1st, 1921	189.11
	$1,369.53

Respectfully submitted,

ARTHUR SURVEYER,
Chairman.

J. L. BUSFIELD,
Secretary-Treasurer.

Quebec Branch

The President and Council,

The Quebec Branch submits its Annual Report for the year 1920.

Our Branch is composed as follows:—

Members	15
Associate Members . . .	53
Junior members	9
Students	14
Total	91

The Quebec Branch held 8 meetings during the year.

All questions submitted by the Council of *The Institute* and by the different Branches have been studied, discussed and transacted.

As in the past, our Branch has followed with interest *The Institute's* deliberations and has devoted its full energy to all matters tending to the protection and promotion of the interests of *The Institute* and its members.

The Quebec Branch has performed considerable work during the past year, regarding provincial legislation and we are pleased to announce that efforts along this line have been crowned with full success.

A thorough study has been made by a Committee of this Branch as regards classification and compensation of engineers; a report to that effect was prepared and copy has been transmitted to the Council of *The Institute* and to all its Branches.

The Legislation Committee has continued, as in the past, to follow closely, study seriously and make as complete a report as possible on all applications for membership which have been referred to this Branch, and the necessary recommendations have been made to the Council of *The Institute* which has kindly taken them into consideration.

The financial standing of our Branch is very satisfactory; the cash on hand on the 31st of December is $486.58.

Respectfully submitted,

A. R. Decary,
Chairman.

A. B. Normandin,
Secretary-Treasurer.

Au Président et aux Membres du Conseil,
l'Institut du Génie, du Canada.

La section de Québec a l'honneur de vous soumettre son rapport annuel pour l'année 1920.

Notre section se compose comme suit:—

Membres	15
Membres associés	53
Membres juniors	9
Etudiants	14
Total	91

La section de Québec a tenu huit assemblées durant l'année. Toutes les questions soumises par le Conseil de *l'Institut* et par les différentes sections ont été étudiées, discutées et transigées.

Comme par le passé, notre section a suivi avec intérêt les travaux de *l'Institut* et a prêté son plein concours à toutes les questions ayant pour but de protéger et de promouvoir les intérêts de *l'Institut* et de ses membres.

La section de Québec a fait un travail considérable durant l'année écoulée en rapport avec la législation provinciale et nous sommes heureux de vous informer que ce travail a été couronné d'un plein succès.

Une étude approfondie a été faite par un comité de notre Section relativement à la classification et à la rémunération des ingénieurs; un rapport à cet effet a été préparé et copie en a été transmise au Conseil de *l'Institut* et à toutes les Sections.

Le comité de Législation s'est occupé comme par le passé de surveiller, de faire une étude sérieuse et de faire un rapport aussi complet que possible sur toutes les demandes d'admission qui lui ont été référées, et les recommandations nécessaires ont été faites au Conseil de *l'Institut* qui a bien voulu en tenir compte.

La position financière de notre section est excellente; le montant en caisse au 31 décembre 1920 est de $486.58.

Respectueusement soumis,

A. R. Decary,
Président.

A. B. Normandin,
Secrétaire-Trésorier.

St. John Branch

The President and Council,

There were nine meetings of the Executive held during the year, at which considerable business was transacted. There were eight meetings of the Branch at which many interesting papers were read and discussed. One meeting, at which Town Planning was discussed, was held in conjunction with the St. John Board of Trade.

The Act, known as the Engineering Profession Act, which was prepared last year passed the Provincial Legislature during the 1920 session and became law. The Association of Professional Engineers of the Province of New Brunswick, provided for under the Act, was organized at a meeting held in St. John on Sept. 10th. The carrying forward of this legislation and the extensive work in connection therewith are a credit to the members of *The Institute* who spent considerable time in its preparation.

The several Committees of the Branch have done effective work. The work of the Branch has been brought to the attention of the public and the advice of its members on public questions has been sought after.

The membership at the end of the year is as follows:

Grade	Resident	Non-Resident	Total
Members	12	6	18
Assoc. Members	29	5	34
Juniors	8	2	10
Associates	1		1
Hon. Affiliates	1		1
Affiliates	10		10
Total end of year 1920			74
Total end of year 1919			63
Net gain			11

The financial statement for the year ending Dec. 31st. 1920, is as follows:—

Receipts ;

Balance from 1919	$60.11
Rebates on dues from Headquarters	96.80
Dues and subscriptions from Affiliates	18.00
Branch News	19.45
Special Entertainment Subscriptions	51.25
Total	$245.61

Expenditures ;

Postage	$17.11
Stationary and Printing	27.66
Telegrams	1.04
Entertainment	51.25
Janitor Services	4.00
Lantern Slides, Halifax Meeting	9.00
Advertising	2.70
Journal subscriptions (Affiliates)	6.00
Sundry Expenses	4.30
Total	$123.06
Balance on hand	122.55
	$245.61

Respectfully submitted,

Gilbert G. Murdoch,
Chairman.

Harry F. Bennett,
Secretary-Treasurer.

Moncton Branch

The President and Council,

At a meeting of the Corporate Members of *The Engineering Institute of Canada* held in Moncton, N.B., on June 11th, 1920, it was decided to apply to the Council for the necessary permission to form a local Branch and an Organization Committee was appointed for the purpose of organizing.

The Council having granted permission to form a Moncton Branch, the formation meeting was held on October 11th. Fraser S. Keith, general secretary of *The Institute* was present and gave a very interesting address on the organization of *The Institute* and what was being done to further the standard and welfare of the engineers throughout Canada. At the conclusion of the address By-Laws were drawn up and ordered to be sent to the Council of *The Institute* for approval. Officers were also elected at this meeting as follows:—

W. A. Duff, M.E.I.C., Chairman,
J. D. McBeath, M.E.I.C., Vice-Chairman,
M. J. Murphy, A.M.E.I.C., Secretary-Treasurer,

and the following Executive:

R. McManus, A.M.E.LC.,
H. J. Crudge, A.M.E.I.C.,
J. Edington, M.E.I.C.,
S. B. Wass, A.M.E.I.C.,
F. B. Fripp, A.M.E.I.C.,
R. G. Gage, M.E.I.C.

The regular monthly meetings of November and December were well attended, and at the December meeting a very interesting paper was read by F. H. Williams, A.M.E.I.C., on the "History and Survey of Electric Welding Methods", illustrated with lantern slides.

The membership of the Branch is as follows:—

Members	10
Associate Members	19
Juniors	4
	33

There are twenty applications pending and no doubt our next Annual Report will show quite a satisfactory increase in our membership.

The financial statement is as follows:—

Advance rebate from Headquarters		$50.00
Expenditure:—		
Postage, long distance telephone, telegrams, etc.	$3.52	
Cash on hand	1.48	5.00
Balance in Bank		$45.00
Quarterly rebate, etc., due from Headquarters		$12.47
Total Assets		$57.47

Respectfully submitted,

W. A. Duff,
Chairman.

M. J. Murphy,
Secretary-Treasurer.

Halifax Branch

The President and Council,

During the year six meetings were held as follows:—

February 16th. — A special meeting at which was shown a film from the Koppers Manufacturing Co., illustrating a modern by-product coke plant.

February 27th. — At this meeting the standard Branch by-laws were adopted and the officers for 1919 were continued in office until the new annual meeting of the Branch in May. K. H. Smith, M.E.I.C., read a paper on "The Water Powers of Nova Scotia".

March 26th. — At this meeting was presented the report of a committee appointed to investigate some of the projects for the proposed Halifax-Dartmouth bridge.

May 13th. — The Annual meeting of the Branch. Reports from the Chairman and the Secretary-Treasurer were presented. The following officers were elected for 1920-1921:—

Chairman...	C. E. W. Dodwell, M.E.I.C.	
Sec.-Treas...	F. R. Faulkner, M.E.I.C.	
Executive...	K. H. Smith, M.E.I.C	for 2 years
	W. P. Morrison, M.E.I.C.	
	L. H. Wheaton, M.E.I.C.	
	H.W. L. Doane, A.M.E.I.C.	for 1 year
	J. L. Allan, M.E.I.C.	
	A. G. Robb, M.E.I.C.	

November 17th. — This meeting was devoted to a discussion of fees and salaries of Professional Engineers. A committee of five was appointed to bring in a report on classification as a preliminary to a schedule of fees and salaries.

December 15th. — Col. W. E. Thompson gave a talk on the Water Supply of Halifax from the standpoint of the fire underwriters followed by Col. F. W. W. Doane, M.E.I.C., from the standpoint of the city engineer.

In addition to the above meetings, the Eighth General Professional Meeting was held in Halifax on October 13, 14, and 15.

Membership is as follows:—

Members	29
Associate Members	48
Juniors	18
Students	16
Branch Affiliates	6
Total	117, a net gain

during the year of 20.

Financial Statement for 1920

Balance, January 1st, 1920		$ 98.96
Receipts		
Rebates from Head Office	$177.10	
Branch Affiliate Fees	34.70	
From Halifax-Dartmouth Bridge Committee	94.50	
Bank Interest	3.93	
Examination Fee	5.00	
Total	$315.23	315.23
		$414.19
Disbursed		
Clerical Help	$ 60.00	
Office Supplies	3.00	
Postage	17.43	
Entertainment of Guests	3.90	
Expenses of Meetings	3.75	
Telegrams	.31	
Bank Charges	.70	
Journal Subscriptions for Branch Affiliates	12.00	
Printing	43.75	
Express	.70	
L. H. Wheaton, Professional Services	94.50	
Presentation to K. H. Smith	4.50	
Total	$244.54	$244.54
Balance, January 1st, 1921		$169.65

Respectfully submitted,

C. E. W. DODWELL,
Chairman.
F. R. FAULKNER,
Secretary-Treasurer.

Professional Papers

Mechanical and Electrical Equipment of the Toronto Union Station*

A general survey of mechanical and electrical equipment for the new Union Station, including heating and ventilation, lighting, elevators, power equipment, fire-alarm systems, etc.

Walter J. Armstrong, A.M.E.I.C.

Advance Proof of Paper to be Presented at the General Professional Meeting, Toronto, February 3rd, 1921

Foreward

This building is being erected for the Toronto Terminals Railway Company, which company was formed by the Grand Trunk and Canadian Pacific Railways to carry out the Toronto Terminals development. The technical representative of the company was J. R. W. Ambrose, M.E.I.C., chief engineer.

The building was designed and is being erected under the supervision of the Toronto Terminal Architects, made up of Messrs. Ross and Macdonald, Hugh G. Jones of Montreal, and a Toronto associate, John M. Lyle.

The engineers appointed to design and supervise the installation of the service work were T. Jeffreys Ashe and Walter J. Armstrong, A.M.E.I.C. Shortly after the design work was started Mr. Ashe severed his connection with the undertaking.

General Explanation

The building is divided into three sections, namely: East Wing, Centre Block and West Wing. The East Wing is to be occupied by the Post Office Department and will be known as "Postal Station A". This portion of the building is being erected by the Toronto Terminals Railway Company for the Government. (This portion will be referred to hereinafter as "The East Wing".) The Centre Block and West Wing portions of the building consist of the Station proper and Railroad Offices. (These portions will be referred to hereinafter as "The Main Building".) As these two portions of the building will be for all intents and purposes two buildings, separately owned, maintained and operated, it was necessary to make the plants for same entirely separate and independent, thus a certain amount of duplication was necessary. Steam for heating, etc., and electrical energy for light, power, etc. are or will be purchased from outside companies, thus an electrical energy and steam generating plant has not been provided. Electrical, energy for all services will be brought into the building by the companies from which such service is taken through conduits provided as part of the building.

Division of Equipment

The service equipment for a building such as this may be divided into two main branches, namely: "Mechanical" and "Electrical", although it is customary to supply some electrical apparatus, such as motors, starters, etc. as part of the mechanical equipment, and although there are many mechanical features in connection with the electrical apparatus, particularly elevators.

Heating and Ventilating

General

Steam for all purposes will be brought to the building by two steam lines, one 8 in. in diameter known as the Winter Line, and one 4 in. in diameter known as the Summer Line. This steam will be delivered at the building at a pressure ranging from 125 to 175 lbs. per sq. in. These lines after entering the building are connected through reducing valves to two high pressure distributing lines, also designated as Summer and Winter lines, the reducing valves being designed and set to maintain the pressure at approximately 100 lbs. per sq. in. Branches are taken from these lines at various points and connected through reducing valves to low pressure lines from which connections are taken to converters, indirect heaters, domestic water heaters, laundry, kitchen, etc. The pressure in these lines being practically atmospheric in some cases, and as high as 80 lbs. in the case of the laundry.

Steam flow meters are provided for measuring the entire quantity of steam supplied, also for measuring that portion used by the East Wing. Condensation meters are also provided for measuring the water condensed in the lines carrying steam to the building. In most cases loops are provided in each fan or heater room and connected through the reducing valves mentioned above to both the high pressure distributing lines. Connections are taken from these loops to the various heaters.

When the designs were practically completed for the heating and ventilating work, it was learned that the company supplying steam did not desire the condensation returned to their plant. It was therefore thought advisable to utilize if possible this condensation having a temperature of approximately 200 degrees Fahrenheit, rather than waste this amount of heat by discharging same into the sewer. Due to the constantly changing quantity of condensation, a practical use for same was not readily found. Finally it was decided to use this condensation in the various plumbing fixtures requiring hot water. This is accomplished by delivering all condensation to a receiver in each section of the building, from which it is pumped to storage tanks located at the top of the building. It passes by gravity from these tanks through domestic water heaters, which, by means of thermostats, provides water at the fixtures at any desired pre-determined temperature. Auxiliary equipment is provided so that only such quantities of this condensation will be pumped to the tanks as can be used. If the condensation is not sufficient at any time to supply domestic requirements, make-up water from the City will automatically supply the need.

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Both sections of the building are heated by direct radiation, except some of the larger spaces in the Main Building, such as the Ticket Lobby, Exit Concourse, etc., which are heated by Indirect Systems.

Direct Heating

Each portion of the building is heated by a forced hot water Direct Heating System. The water is heated in converters by low pressure steam and forced through the pipes and radiators by means of turbine driven pumps; the converters and pumps being provided in duplicate and located in the sub-basement. Supply and return mains, in general, are located at the ceiling of the sub-basement or in pipe tunnels, from which branches are taken for connection with all risers and sub-branches to the various units of radiation. As the centre portion of the Main Building is somewhat higher than the Wing, and as only a small portion of this upper part requires direct heating, a low pressure steam system was used to avoid increasing the static pressure on the hot water system. The exhaust from the turbine driven circulating pumps is used in the converters.

The temperature of the water circulated through radiators is automatically controlled by means of thermostats located in one of the typical larger spaces or offices for each portion of the building, the space selected having average severe exposures. These thermostats control valves located on the drip or return lines from the converters, thus controlling the amount of steam used.

Indirect Heating and Supply Ventilation

Air for indirect heating and supply ventilation is taken from or near the top of the building, shafts being provided from these intakes to the fan rooms located in the sub-basement. The air passes from these shafts successively through tempering heaters, air washers, re-heating heaters and fans to the ducts in the case of supply ventilating systems and from the air washers through fans, re-heaters and plenum chambers in the case of indirect heating system. The temperature of the air passing through the air washers and leaving re-heating heaters is automatically controlled.

View of a Fan Room, showing Vacuum Pump, Plenum Chamber, Air Washer Duplex, Ejector and Branch Distributing Switchboard.

The plenum chambers are divided into two sections, one containing hot air, the other tempered air. These sections are connected to a mixing chamber through dampers, which are controlled automatically by a thermostat in the room and operated by compressed air, thus the temperature of air supplied the room is such to maintain that room at any pre-determined temperature. The fresh air shafts are connected to the discharge chambers of the fans exhausting air from the larger spaces, dampers being provided so that any desired amount of this air may be re-circulated. Twelve fans are provided for indirect heating and supply ventilation, handling a total quantity of air of approximately 232,000 cu. ft. per minute, of which 120,000 cu. ft. per minute may be re-circulated. Most of the remaining 112,000 cu. ft. is supplied to such rooms as toilets, kitchen and service rooms, etc., and thus is not suitable for re-circulation. A smaller number of units could have been provided, but as certain spaces, such as kitchen, restaurant, lunch-room, waiting room, offices, etc., are not continually in use, are not in use simultaneously, it was found economical to provide a sufficient number of units to avoid ventilating such spaces except when occupied.

Exhaust Ventilation

Air is exhausted mechanically by means of fans from various rooms and spaces and is discharged through hoods or louvres on or in the roof of the building. As stated above, the discharge chambers of the fans exhausting air from the larger spaces are connected through dampers to the fresh air shafts. Fourteen exhaust fans are provided to handle a total quantity of air of approximately 180,000 cu. ft. per minute, which amount includes capacity for exhausting air from toilets, etc. which may be provided in connection with the track development. As in the case of indirect heating and supply ventilation, the number of units provided was decided upon in order to obtain maximum economy in operation.

Steam for Kitchen, Laundry, etc.

Steam for kitchen, lunchrooms and laundry equipment is taken from the 100 lb. pressure lines and reduced to 80 lbs. for the laundry; to 40 lbs. for kitchen and lunchrooms equipment, except vegetable and pastry steamers, for which it is reduced to 10 lbs. pressure. Individual steam traps are provided on all such equipment, the condensation being returned by gravity to the receivers mentioned above under "General".

Steam for Car Heating

Provision in the way of plugged or blank flanged tees has been made in the 100 lb. pressure steam lines for car heating. These tees are located at various intervals in the pipe tunnels along the south side of the building.

Domestic Water Heating

Six heaters are provided for heating water for domestic purposes, two of which are located in the East Wing for all purposes; two are located in the Main

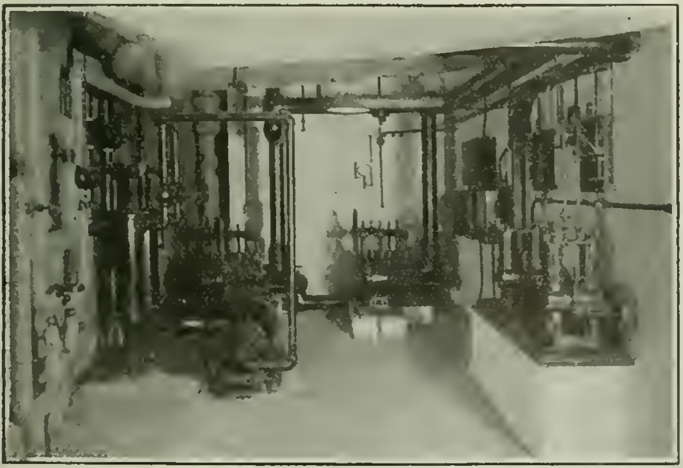
Building for heating water for all toilet rooms. The two pair of heaters mentioned above are arranged to act as boosters for heating condensation discussed above under "General". The remaining two heaters are used for supplying hot water for the kitchen, lunchrooms and laundry equipment in the Main Building. Steam at from 2 to 5 lbs. pressure is delivered to these heaters. The temperature of water is thermostatically controlled. Individual traps are provided for each heater, the condensation lines from same being connected to the vacuum return lines from indirect heater and converters, which by means of vacuum pumps deliver all condensation to the receivers mentioned above under "General".

General Information

All fans, motors, pumps, air washers, etc. are numbered to correspond with numbers on the drawings and in the specifications and in the case of motors to correspond with numbers on the switches on boards or in panels. All pipes and ducts are labelled showing what they are for, to what apparatus they connect or what room or portion of the building they lead to. Indicating gauges are provided for each line in easily accessible places in order that pressure in any lines may be known at any time. These gauges are labelled to show which line they are connected to. All valves are tagged and the number on the tag corresponds to a number on a chart which again shows the location of the valve and its purpose.

Compressed Air

Provisions has been made for the installation of air compressors in the sub-basement for supplying air for testing brakes and charging the reservoirs on cars, for operating track signals and switches, for cleaning motors throughout the building and for supplying air to the temperature regulating apparatus used in connection with the heating equipment. At the present time none of this equipment has been installed, except pipe lines to the various fan and pump rooms with hose outlets for blowing out motors and to the temperature regulating air storage tanks.



View of a Corner of a Machine Room, showing Air Compressor for Temperature Regulating System—Drinking Water Circulating Pump, and Air Washer Pump and Filters

Plumbing

This division may be sub-divided under the following headings:—

"Drainage, Sewerage and Vents"
"Water Supply and Distribution"
"Drinking Water Cooling and Distribution"
"Fire Protection"
"Gas Supply".

Drainage, Sewerage and Vents

It was necessary to separate all clear water drainage from the sewage, thus a separate system of lines was provided for carrying off all sewage, which lines are connected to the City trunk sewer in Front Street at two points, one for the East Wing and one for the Main Building. The systems of lines for carrying off all clear water drainage are connected to a trunk line along the south side of the building, which is connected to the City storm sewer in Bay Street. Three connections are made to the trunk line, one for the East Wing, one for the Centre Block and one for the West Wing. This line is sized with connections left for carrying off all clear water drainage in connection with the Train Sheds and track development.

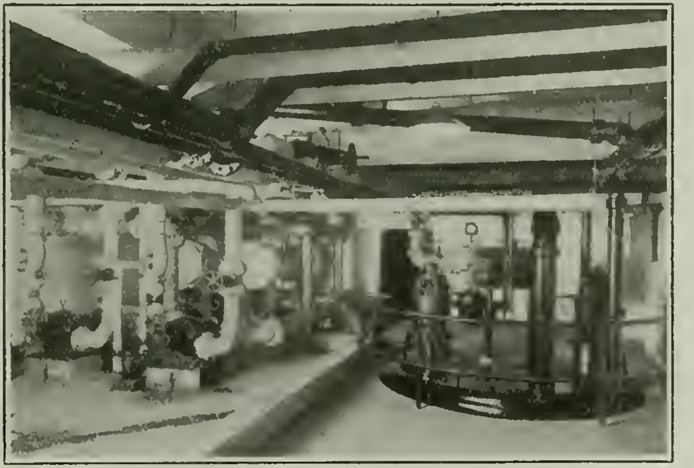
As the basement level, including the driveway, is so near the level of the City sewers, and as the capacity of these sewers is rather taxed during heavy storms, partly due to being located so near the level of the lake, it was necessary to provide sewerage ejectors for pumping all sewage and drainage from fixtures, catch basins, floor drains, etc. on the basement level as well as for all apparatus and equipment in the sub-basement. These ejectors are of the automatic duplex type so arranged that one unit only operates, except at such times when one can not take care of the inflow, then the second unit will automatically start in order to take care of the total inflow. There are eight of these outfits provided, the smallest having a total capacity of 150 gallons per minute, the largest 800 gallons per minute.

Water Supply and Distribution

Water supply for both buildings is taken from the 100 lb. pressure City main in Front Street. Separate services are brought in for each portion of the building. After fire protection connections are made thereto, meters and reducing valves are installed, the latter to reduce the pressure to approximately 60 lbs. for distribution through the building. Provision was made for the installation of pressure filters in both portions of the building primarily for the elimination of sand, but they have been installed in the Main Building only.

Supply mains are run up through the building and connected to storage tanks located at the top of each building. Two storage tanks are installed for each building, one for supplying cold water, the other for supplying hot water to the fixtures, etc. The hot water tanks are used in conjunction with the equipment for utilizing condensation described hereinbefore under "General" of

"Heating and Ventilating". From the cold water tanks a system of distributing mains are installed above the top floor ceiling with drops taken therefrom for supplying cold water to all fixtures throughout the building. Cold water supply to drinking water systems and to refrigeration machines is taken direct from the supply mains to tanks in order to obtain the coolest water possible for these purposes. From the hot water tanks, lines are run to the domestic water heaters in the sub-basement, and in the case of house heaters main risers are carried up through the building to above the ceiling of the top floor with distributing mains and drops taken therefrom as described above for cold water. The bottom of all such drops and branches to each group of fixtures are continued to the basement or sub-basement ceiling and connected to the heaters to form a system of circulation. The supply from the kitchen and laundry heaters is carried only to the ceiling of the first floor with drops, circulating lines, etc. provided as for the house heaters.



View of Pump Room showing Heating System Converters, Turbine Driven Pump and Duplex Ejectors

All condensing water used in connection with the drinking water cooling machines and the refrigeration and ice making plant for kitchen and lunchrooms is discharged into suction tanks from which it is pumped into storage tanks at the top of the building and used through fixtures. These pumps are of the triplex type, motor driven, and are operated automatically by means of a float controlled switch.

Drinking Water Cooling and Distribution

Small refrigerating machines are installed for cooling water for drinking. These machines are motor driven and are automatically controlled by thermostats so arranged that the water may be maintained at any predetermined temperature. They are also equipped with automatic devices, not only for starting and stopping the machines, but also for opening and closing valves on the condensing water supply so that no water is being wasted when the machines are not operating. From the cooling tanks the water is circulated through supply mains located in the pipe tunnels or on the basement ceiling by means of motor driven triplex pumps. Risers are taken from these mains and run up through the building with short branches taken therefrom to the various fountains. The tops of these risers are joined above the ceiling of the top floor to form a circulating system and are connected to balancing tanks provided to maintain a reserve, also a constant pressure at the fountains. The surplus in these tanks overflows and is returned to the cooling tanks and re-circulated. Fountains in general are provided in all public rooms, in office corridors and large working spaces; faucets are provided for various sinks in the lunchrooms and kitchen.

Fire Protection

Provision in the way of protection against fire has been made by means of stand pipes running up through the building at various locations with hose outlets, hose, etc. located on each floor so that every portion of the building can be reached by means of a hose. At each outlet a 75-ft. length of 1½" hose with nozzle, etc. is connected to the stand pipes through 1½" valves. In addition to this a 2½" valve has been provided with nipple treaded for City fire Department hose. The distributing mains in the sub-basement are connected to the water supply lines to the building through check valves. They are also connected to the cold water storage tanks at the top of the building through check valves so that in case the City supply should be interrupted at any time water in the tanks is automatically available for fire fighting purposes.

Gas Supply

In the Main Building gas is provided only for cooking purposes in the kitchen, bakery and lunchrooms, and for emergency lighting in the main switchboard and transformer rooms.

In the East Wing, in addition to provision for the above mentioned purposes, gas is also provided for emergency lighting throughout the building; each alternate electric lighting outlet is provided with a gas outlet.

General Information

All motors, pumps, etc. are numbered, pipes are labelled and valves tagged, as described under "Heating and Ventilating".

Refrigeration and Ice Making Equipment

A Refrigeration Plant has been provided in the Main Building for cooling the various refrigerator boxes in and for making ice for the kitchen, lunchrooms and restaurant. This is a compression plant, the refrigerant being ammonia. There are two 8-ton vertical single acting enclosed twin cylinder type compressors, driven through turbo type reducing gears by motors; a double pipe condenser divided in two sections; a combined brine storage and cooler and 3-ton ice-making tank with the necessary auxiliary apparatus and equipment, including brine circulating pumps, brine distributing mains, cooling coils in boxes, ammonia piping, etc. The plant is designed to have a refrigerating capacity equivalent to the melting of 16 tons of ice per twenty-four hours when operating with a suction pressure of 15 lbs. and a maximum discharge pressure of 175 lbs. per square inch of the ammonia. The compressors are designed to do this work at a speed not exceeding 155 revolutions per minute.

Pneumatic Tubes

Two systems of pneumatic tubes are provided in the Main Building.

One consists of a system of 4″ independent vacuum power control pneumatic despatch tubes between the baggage checking room in the ticket lobby and three sending and receiving stations at various locations in the baggage room in the basement, there being a total of six tubes. This system is used for carrying baggage and cartage checks. A displacement blower is provided for actuating the carriers through the tubes, which blower, by means of electrical controlling apparatus, automatically speeds up when a carrier is inserted at a station. The controller is equipped with a dash-pot with pilot valve, adjusted to release the switch after any pre-determined interval.

The other consists of a system of 2¼″ independent vacuum pneumatic tubes between the Pullman and Sleeping Car Ticket Offices in the Ticket Lobby and G.T.R. and C.P.R. Telegraph Offices on the 4th and 3rd floors, respectively, there being a total of four tubes. These tubes are provided for carrying telegrams. The carriers are actuated by means of a displacement blower.

Scales

Scales are provided in the basement of both the East and West Wings, the former for weighing mail and parcels and the latter for weighing baggage.

There are two scales in the East Wing, each having a weighing capacity of 10,000 pounds with platform 12 ft. long by 6 ft. wide. There are five scales in the West Wing, four of which have a weighing capacity of 2,000 pounds with platforms 4 ft. by 4 ft. The fifth scale has a weighing capacity of 10,000 pounds with platform 12 ft. long by 6 ft. wide.

All these scales, in both sections of the building, are of the automatic indicating dial type.

Kitchen and Lunchroom Equipment

Equipment is provided in the kitchen for A la carte service for the restaurant and for the preparation of ready-to-serve foods for the lunchrooms.

This equipment includes gas ranges, broilers, vegetable steamers, stock and grease kettles, cooks' table with Bain Marie, hot top and sink, sinks, warmers, whipping machines, vegetable peeler and tables, etc.; serving pantry equipment, such as urns, griddle and toaster, egg boilers and sinks; bakery equipment, such as oven, dough mixer and trough, ice cream freezer, pastry steamer, tables and sinks; butcher shop equipment, such as meat chopper, slicer, sink, tables and block; ice room equipment, such as ice crusher and cuber; glass and silver pantry equipment, such as sinks, polishing machine, etc.; dish washing pantry equipment, such as dish washing machine, sink, counters and racks; oyster and fish preparation equipment; laundry equipment, such as washer, flatwork ironer, extractor, ironing board and iron; and helps' dining, locker and toilet rooms, also refrigerators for prepared and raw foods. The laundry is provided for the purpose of taking care of all table linens, coats and aprons and towels for pay toilets, baths and the barber shop.

Exhaust hoods are installed over the principal cooking apparatus, dish washing machine and flatwork ironer for carrying off steam, odors and heat.

In addition to the above equipment such as steam tables, urns, broilers, griddle, toasters, warmers and oyster stewers, etc., is provided in the main and cabmen's lunchrooms, also refrigerators for ice cream and other ready-to-serve foods and drinks. A feature in the main lunchroom is the oyster serving section where provision is made so that oysters may be opened, stewed or served on the half-shell in full view of the patrons.

The main lunchroom and restaurant are located on the first or main floor, the cabmen's lunchrooms, in the basement.

Mail Conveyors, Carriers and Chutes

Belt Conveyors

A system of belt conveyors is provided for carrying letters from the drops at the front of the East Wing to the 2nd floor stamping tables. These conveyors are made in three sections, two of which are horizontal, of the belt type, 24 in. wide, located at the ceiling of the basement; the third is of the inclined bucket type, 30 in. wide, running from the basement to the 2nd. floor where it discharges letters by means of a pivoted chute on either of two facing or stamping tables. These conveyors are motor driven, a separate motor being provided for each.

Steel Friction Chute

A steel friction chute has been installed to deliver letters from the main floor drops either to the belt conveyors described above or to receiving table in the basement. This chute will carry mail from both the inside and outside drops at the Post Office entrance. It is provided with a lever actuated counter-balanced hinged section, which in one position delivers mail on the conveyor and in the other position delivers mail on the receiving table in the basement.

Pick-up and Delivery Carrier

A pick-up and delivery carrier for handling special delivery letters is provided between the first and second floors, designed for picking up letters at two points and delivering in the special delivery room on the 2nd floor. This carrier is such that by placing letters on receiving shelves at either pick-up stations, they will be automatically picked up and carried to the receiving station where they will be automatically delivered. This carrier is equipped with four cars, two of which operate at one pick-up station, the other two at the second pick-up station. These cars are designed for handling single letters or packages of letters not exceeding a size of 12 in. long by 6 in. wide by ¾ in. thick and not weighing over one pound. This conveyor is motor operated.

Spiral Chute

A double spiral chute is provided to carry parcels, books and newspapers from the drops at the main entrance and deliver same on to receiving tables in the basement. The curvature of this chute is such that packages, books, etc. of all weights will be delivered on the table at approximately the same speed. One section is for circulars, the other for parcels and newspapers.

Vertical Mail Chutes

Two vertical mail chutes are provided in the Main Building running from the 4th floor to mail boxes on the 1st floor. Chutes have letter drops on each floor.

Motor Operated Rolling Lift Doors

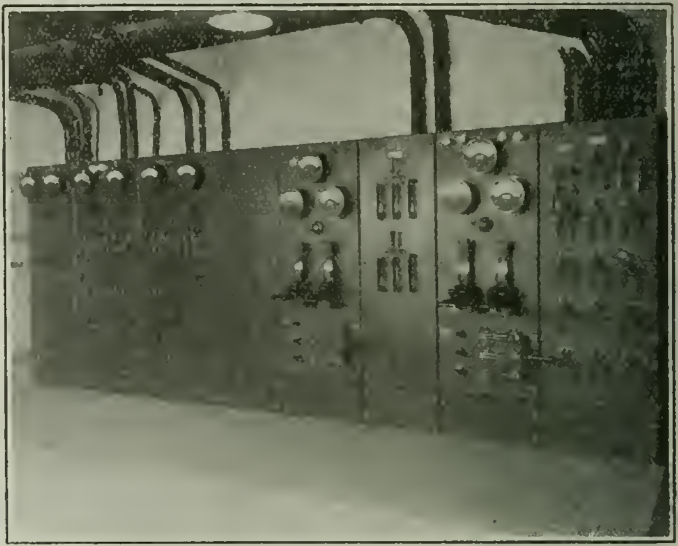
There are five motor operated rolling lift doors in each section of the building; for access to mail receiving room in the East Wing basement, and to baggage room in the Main Building basement. Each of these doors is 18'0" wide and has a lift of 10'6". They are constructed of interlocking metal slats on a spring compensated roller and set in guides at the jambs. The motor and gear train are located at the top and on one side for each door. Each motor is provided with a starter equipped with automatic features to stop motor when door reaches full opened and closed positions. A clutch is provided for emergency operating of the door by hand chain.

Lighting

Lighting service is taken from the Toronto Hydro-Electric System for the East Wing and from the Toronto and Niagara Power Company for the Main Building, the former is 115-230 volts, single phase, 25 cycle, A.C., the latter 115-230 volts D.C. The distributing mains and risers in both cases are 3-wire.

Main switchboards are provided for each portion of the building at the center of distribution as nearly as possible. Feeders are run from these main boards to branch distributing panels located at various places on each floor from which branch circuits are run to all ceiling, wall and base outlets for lighting, vacuum cleaning, disc fans, etc., usually through local switches. Provision is made on each switchboard for two separate and independent services in order to provide against any interruption in the lighting of the building. At the present time only one service is installed for the East Wing. Circuit breakers are provided on each service line to each board; fused switches are provided on all branch feeder lines, the fuses being installed at the back of the boards. Electrical energy for lighting the Ticket Lobby is supplied from six separate panels, controlled from one location by means of instantaneous push button switches operating remote controlled switches in the panels.

In the East Wing there are thirty-three branch distributing panels and in the Main Building there are forty-five. Provision is made in the way of bus capacity and spare switches on the main board in the Main Building for lighting the train sheds and spaces in connection with the track development. Feeders are figured for a voltage drop of 1½% based on a load factor of 80%; branch circuits are figured on a maximum drop of 1½ volts to the farthest lamp.



Front view of one of the Main Switchboards

Copper on switchboards and panels are designed for the following current densities:—

Moving contact services – 60 amperes per sq. in.
Fixed " " –150 " " " "
Current carrying parts –800 " " " "
except cast copper,
which is designed for –500 " " " "

Rubber mats are provided at the front and rear of the boards. The rear of all boards are screened; panels for switchboards are constructed of slate 2 in. in thickness. Plates are provided under each switch on the main boards showing the panel controlled therefrom. Schedules are installed in the back of each panel door showing which circuits each switch therein controls and the room or rooms in which outlets are located.

Power Equipment

As in the case of lighting, power service is taken from the Toronto Hydro-Electric System for the East Wing and from the Toronto and Niagara Power Company for the Main Building. The former is 250-500 volts D.C., the latter is 230 volts D.C. for elevator service and 12,000 volts, 3 phase, 25 cycle, A.C., reduced through transformers to 550 volts for all other purposes. Three single-phase transformers connected in delta are provided for this purpose. The main power switchboards are located alongside the main lighting switchboards and arranged to form one continuous board. Feeders are run from the main boards to branch distributing boards or panels located in the various elevator, pump, fan and machinery rooms.

Provision for two separate and independent services for each type of power is made as in the case of lighting. As lighting and power for elevator services in the Main Building have the same characteristics, provision is made so that they may be fed either from the same or separate services. Circuit breakers are provided on each service to each board, also on branch feeders to each elevator; the latter are equipped with time limit features. Main feeders are figured on a 3-volt drop at 100% load factor, while branch feeders to individual motors are figured on a basis of a 3-volt drop with 125% load factor.

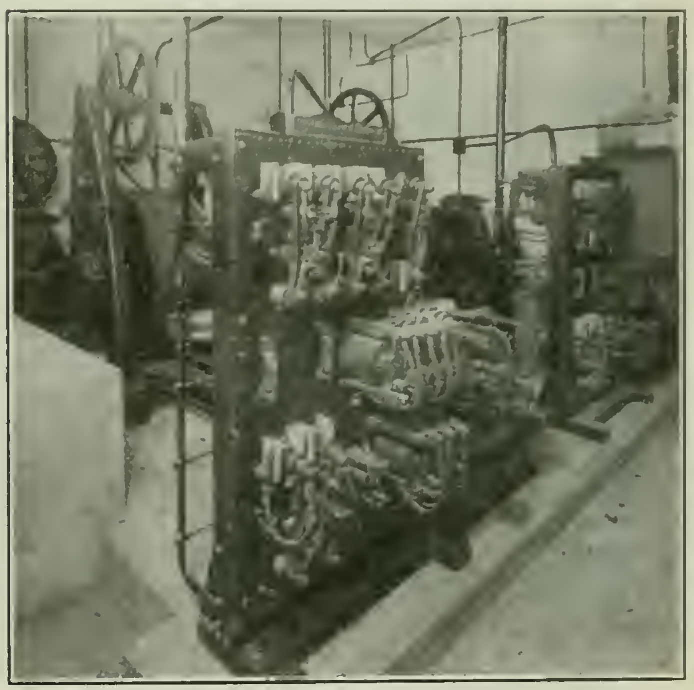
Provision is made on the main board in the Main Building in the way of bus capacity and spare switches for supplying power for operating fans, pumps and hydraulic elevator machinery, in connection with the train sheds and track development. Transformers are oil insulated, self-cooled As in the case of lighting, name plates are provided under all switches on the main boards to indicate the branch distributing boards or panels controlled therefrom, and on the branch boards or panels, plates are provided numbered to correspond with numbers of the motors; also rubber matts and screens.

Elevators

In the original scheme, forty-six elevators were proposed. This was subsequently revised to forty-two elevators, twenty of which are baggage lifts for the train sheds. On the contract drawings for the station building the following elevators, dumb waiters, etc. were provided for: In the East Wing — two passenger elevators, four freight elevators and seven dumb waiters. In the Main Building — four passenger elevators, three freight elevators, one inclined baggage elevator and one baggage chute. Four of the seven dumb waiters have been omitted.

Passenger elevators, with one exception, are of the worm gear double screw drum type with car and drum counterweights, designed for loads of 3,000 pounds at a speed of 300 feet per minute, and are equipped with full electric magnet controller with operating switches in car. The other passenger elevator is of the worm gear single screw drum type with drum counterweights, with full electric magnet controllers, with push buttons in car and at all landings, for operating same. It is designed for a load of 2,000 pounds at 100 feet per minute.

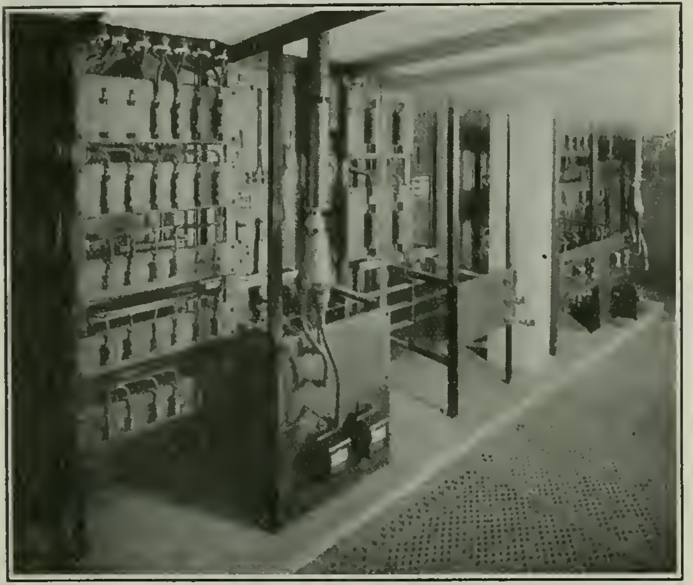
The four freight elevators in the East Wing are of the worm gear double screw drum type, hitched two to one, with drum counterweights. They are designed for loads of 6,000 pounds at a speed of 100 feet per minute. They are equipped with full electric magnet controllers with two operating switches in cars. These cars are 15 ft. 10 in. long by 6 ft. 6 in. wide with an entrance at each end. The dumb waiters are of the worm gear single screw traction type with counterweights, with full automatic magnet controllers with push buttons at the various landings. They are designed for loads of 300 pounds at a speed of 100 feet per minute. The three other freight elevators are of the worm gear single screw drum type with drum counterweights, with full electric magnet controllers with push buttons in car and at all landings. One of these is designed for an operating load of 3,000 pounds, one for 2,000 pounds and one for 750 pounds, all at a speed of 100 feet per minute.



View showing part of a Typical Elevator Machinery Room.

The inclined platform elevator is for conveying hand baggage from the basement to the ticket lobby floor. It consists essentially of narrow boards 3 ft. long, fastened together to form an endless moving platform. It is designed to carry a load of 1,000 pounds at 75 ft. per minute. The chute is of the gravity type for conveying hand baggage from the Baggage Room on the Ticket Lobby level to the basement.

Each elevator is equipped with the usual safety devices. Passenger cabs in the East Wing are constructed of steel, bronze plated; in the Main Building of solid bronze with one exception which is built of steel, finished imitation Bower-Barff. Freight elevator cabs or enclosures consist of metal covered wood wainscotting 6 ft. high with woven wire screens from the wainscotting to an over-head screen. All openings in cabs are equipped with Pit-Bostwick folding gates. Gates and hatch doors for the four large freight elevators in the East Wing are equipped with automatic door operating devices actuated by compressed air. Door and gate switches are provided on all push button operated cars. Passenger and freight elevators equipped with operating switches in cars are provided with hotel flashlight enunciators, two sets of enunciators being provided for the four large freight elevators in the East Wing, one for each entrance. Push button operated cars are equipped with bells on each car and buttons at each landing. Electrical indicators above the entrance doors are provided for all passenger and freight elevators, except the freight elevator for the kitchen. These indicators are of the flashlight type consisting of bronze circular dials, in which are mounted glass jewels one jewel corresponding to each floor served. Behind the jewels are miniature electric lamps. Lamps are automatically illuminated and extinguished by the movement of the car.



Rear View of one of the Main Switchboards.

Fire Alarm and Watchmen's Systems

In the East Wing an automatic fire detector and alarm system is provided. This consists essentially of automatic detectors located near the ceiling of various floors, in machine, fan rooms, etc., and arranged in groups or sections. An indicator board is located in the main entrance lobby. The wiring system between groups of detectors and the board is of the open circuit loop type. Each group of detectors is connected to a separate shutter on the indicator, each shutter showing the location of alarm. In addition to the automatic detectors, manually operated alarm boxes are located on each floor near elevator and stair hall. Gongs are installed at various locations in the building and one outside the building. These gongs are connected in multiple, also using the loop system. Connection is made through an auxiliarized fire alarm box to the City fire department circuit. Storage batteries for operating detectors, etc. are provided, also motor generator set with control panel equipped with automatic make-and-break connecting switch for charging battery.

In the Main Building a supervised code signalling auxiliary local drill fire signal and watchmen's time detector system is provided. This consists essentially of manually operated fire alarm boxes located at various points which are designed to transmit automatically the signal four times through the system; a combined indicator and directory in the main entrance; gongs and directories at various locations and an auxiliarized fire alarm box through which connection is made to the City fire department circuit; also storage battery, motor generator set and controlling switchboard. Boxes are provided with three separate and distinct test devices for testing, or for fire drills, without giving a genuine alarm. Each box is provided with an individual code number, which number is rung on the various gongs and is shown on the indicator. Directories show the location of each station or box in the building. Wiring system is of the closed circuit type. Each box is also equipped with a separate and independent watchmen's mechanism, which is connected to watchmen's time detector through a separate system of wiring, open type. Both systems are operated from the same set of batteries.

Time Clocks and Time Stamps

A system of electric operated time clocks and time stamps is provided in the Main Building. At the present time there are sixteen clocks and seven stamps. All clock movements, except clock located over the information booth in the ticket lobby and the outside clock, are of the self-winding pendulum driven type, arranged to wind and synchronize from a 24-volt central storage battery. These clocks operate continuously under their own power and are equipped with synchronizing devices for receiving hourly correction transmitted from a master clock through a control panel.

The clock over the information booth and the sidewalk clock are equipped with secondary operated half-minute impulse motor driven mechanisms with a 4-way bevelled gear clusters with universal and expansion joints. These movements are arranged to propel the hands electrically with an even motion when circuit is closed and are positively locked between each half-minute impulse. Time stamps are of the minute impulse type, fitted with guides and constructed with mechanism in base. They are wound to operate also from the 24-volt central storage battery. The watchmen's time detector referred to hereinbefore under "Fire Alarm and Watchmen's Systems" is equipped with time dial and is arranged for actuating time detector mechanism when circuits are closed at the various watchmen's stations.

The master clock is a self-winding regulated movement, beating seconds, and is equipped with a 2-jar mercurial compensating pendulum and electric winding motor, designed to wind the main spring automatically at hourly intervals from the 24-volt central battery. It is also equipped with hourly synchronizing and half-minute impulse contacts for actuating the transmitters on the control panel. It is guaranteed to keep accurate time with a variation not exceeding ten seconds per month.

The clock control panel is equipped with mounted platinum tipped sliding contact relays to synchronize hourly five circuits of primary subsidiary clocks and to actuate two secondary half-minute impulse circuits and two 1-minute impulse time stamp circuits with all necessary fuses, strap keys, switches, etc., for cutting in or out all of the circuits. Two half-minute impulse dial clocks are provided for controlling the operation of the two secondary clocks. Storage batteries, capable of supplying 24-volt current, with charging panel, complete with voltmeter, ammeter, no-voltage cut-out, switches and fuses, are provided. Clock cases are constructed of wood, bronze or iron, with brass, glass or marble dials to suit their location. The outside clock, the clock over the information booth and the clock in the baggage room are provided with interior illumination.

Battery Charging Apparatus

Provision was made in both portions of the building for the installation of battery charging equipment for trucks, but up to the present time equipment has been installed in the East Wing only. This equipment consists essentially of charging panel, motor generator set and combined motor and generator panel, charging receptacles and plugs, with the necessary wiring. The charging panel consists of four sections, each complete with rheostat, reverse current relay, meter reading switch, over-load fuses, instrument fuse, indicating lamp and with grid type resistance, mounted on the back. The motor generator set has a rated output of twelve kilowatts at fifty volts D.C. In addition to the usual instruments, etc. for motor and generator panels a self-starter has been provided so that the motor generator set may be started by means of an operating switch located alongside of the charging plugs. The charging plugs and receptacles are double pole, 65 amperes capacity. The complete outfit is designed to charge batteries on four trucks simultaneously.

Telautograph System

Provision has been made in both portions of the building in the way of conduit,. wires, terminal boxes, etc. for the installation of a Telautograph system for transmitting messages dealing with train movements. A transmitter will be installed in the signal tower room with receiving stations installed in such places as the information booth, telephone information room, ticket offices and baggage rooms in the Main Building, and certain sections of the Post Office, in order that these various departments may be informed of the exact time of the arrival and departure of trains. The Telautograph is an instrument which instantaneously transmits by electricity written messages in the actual handwriting of the sender. These messages are transmitted simultaneously to all of the receiving stations.

Systems of Empty Conduits for Telephones, Telegraphs and Miscellaneous Services

Empty conduits are provided from Front Street to telephone and telegraph distributing rooms in the basement for the Main Building and to a distributing box located alongside of the telephone operators' room on the 2nd floor for the East Wing. Empty conduits are run from these rooms and boxes to branch distributing boxes, and in the case of the Main Building to telephone operators' rooms for each railroad company. Empty conduits are also installed from these branch boxes to various floor or wall telephone outlets throughout the building and to the public telephone rooms. A similar system of conduits is provided from the Telegraph Distributing Rooms to Despatchers' and Public Telegraph rooms. Wire moulds in corridors and offices and a space for wires in base boards have been provided for use in conjunction with empty conduits for telephones and miscellaneous services. Separate systems of empty conduits have been provided between various offices for the installation of signal systems for inter-office use, outlets being left under desks or on walls so that push buttons, bells, buzzers and enunciators may be installed without having any wires exposed.

Telephone and Signal Systems for Inspection Galleries

A system of telephone lines and jacks connected with an automatic signal system is provided in the inspection galleries in the East Wing, arranged so that Postal officers may communicate with any inspector in the galleries through the telephone switchboard; arranged so that one inspector at any location in the galleries may signal and communicate with any other inspector and arranged so that an inspector in the galleries may communicate with the Postal officers at their offices or homes. There are approximately forty sets of two telephone jacks. Each inspector in the galleries carries a portable 'phone and by connecting this phone to the first of any pair of jacks he becomes connected with the telephone switchboard, and thus can communicate with any officer having a telephone. By connecting his 'phone to the second jack, he automatically lights up small signal lights distributed through the galleries which provides a silent call to any other inspector. When the second inspector plugs in he is in communication with the first inspector. If the chief inspector desires to communicate with an inspector in the galleries the switchboard operator by connecting to the inspection galleries circuit also automatically lights the same signal lamps. The signal system is separate and independent of the telephone system, except that it is connected to the talking circuits through a solenoid switch. The signal lights are on a 110-volt circuit.

Bell Signal Systems for Doors

Bell signal systems are provided for the larger motor operated doors on the basement floor. These systems consist essentially of push buttons located on the outside of each door connected with a bell located inside over the same door. These systems are operated by current through transformers from A.C. circuits in both portions of the building.

Interphones

A system of intercommunicating telephones has been provided for use in connection with baggage service. One telephone is located in the baggage agent's office, one in the baggage checking room on the ticket lobby level and three in the main baggage room on the basement level.

Provision is made for installing two telephones in the train sheds, one at each end. These telephones are of the type which permits any one calling any of the others.

Illumination and Lighting Fixtures

The illumination of various rooms and spaces in both portions of the building is figured for an intensity of from one to ten foot candles at the working level. Corridors and toilet rooms are figured for an intensity of from one to three foot candles; private and general offices from five to seven foot candles, drafting rooms ten foot candles and public rooms from two to four foot candles.

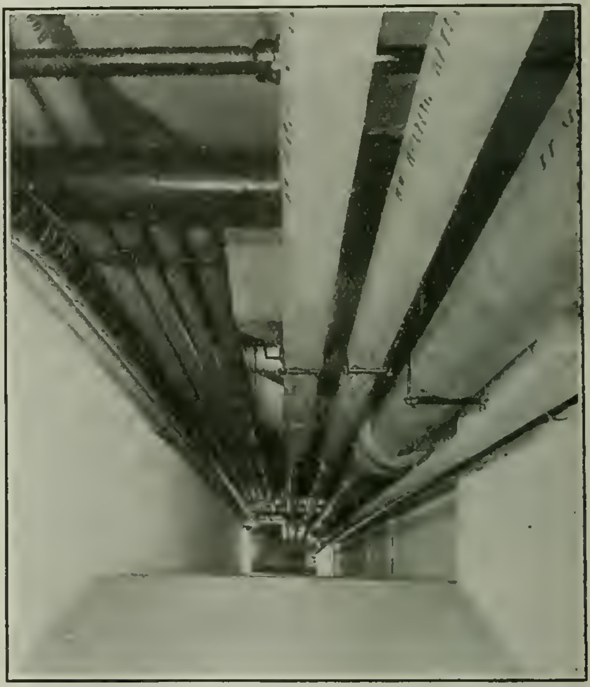
In the offices the lighting fixtures are of the semi-indirect type. In the large working spaces in the East Wing the fixtures are of the ball direct type, every alternate outlet being equipped with two such balls, one fitted with a 500 watt nitrogen lamp, the other fitted with five Welsbach gas burners, the latter to be used for emergency lighting in case the electric energy fails at any time. Office corridors and toilets in general are fitted with ball type fixtures; main entrances are fitted with lantern, ball or dome type fixtures, designed to fit in with the Architectural treatment.

The waiting room and restaurant are lighted by concealed lights above skylights, supplemented by bracket fixtures, of special design to suit architectural treatment. Such rooms as the women's rest room and smoking room are equipped with ornamental fixtures for general illumination, supplemented by bracket fixtures. The barber shop is lighted by indirect fixtures, supplemented by brackets for each chair and over the manicure tables. The ticket lobby will have concealed indirect lighting system, supplemented by ornamental fixtures at the various entrances and exits and by local brackets or reflectors at the various ticket, baggage, parcel and concession windows. The ramp loggia behind the colonades at the front of the centre block will be illuminated by means of flood lights located in pedestal fixtures, designed so that the source of light will be concealed.

The driveway at the basement level and at the front and two ends of the building is lighted by bracket fixtures of the ball type, located on the Front Street retaining wall or on columns between the right and left driveway spaces. The waggon space at the East and West ends of the building and the cabstand at the north end of the west wing are lighted by direct type of fixtures with reflectors and locking protecting screens. The cab arcade is lighted by direct ceiling fixtures of the ball type, supplemented by direct lighting around the outside of the marquise, which is also the case for the waggon spaces at the east and west ends of the building. Store rooms, fan rooms, machinery rooms, pipe tunnels, etc. are lighted by lamps in Edison base receptacles or by direct fixtures, using enameled steel reflectors with drop cords.

High Pressure Steam Lines between the Scott Street Plant of the Toronto and Niagara Light and Power Company and the Station Building

Two steam lines, one 4 in. primarily for Summer use and the other 8 in. primarily for Winter use are installed between the Station building and the Scott Street plant of the Toronto & Niagara Power Company, for conveying steam to the Station for all purposes; also for supplying steam for car heating and for heating and ventilating all rooms and spaces to be erected in connection with the track development at the south of the building. These lines enter the building at the south east corner of the Centre Block. From this point they run parallel to the building to the east side of Bay Street, from which point they run a little south to the south west corner of the present Customs Building on Esplanade Street, then a little north of east to the west side of Yonge Street and from Yonge Street they run parallel to the tracks to the foot of Scott Street, then under the tracks to the Power Company's Plant.



A Typical Pipe Tunnel

It was the original intention to give these lines a gradual slope from the Scott Street plant with the flow of steam to the Station Building, but due to sewer and water mains in Bay, Yonge and Esplanade Streets, and due to electric conduits on Esplanade Street, this was found to be impossible without carrying the lines at a prohibitive depth. These lines leave the Station building at an elevation of minus 2. To give a comparative idea of the depth of these lines in the ground it may be stated that the high water line of the lake is plus 4, and the elevation of top of rails at Yonge Street is plus 8.33. These lines slope slightly upward from the building to the East side of Bay Street where they rise to an elevation of plus 2.38, from which point they again slope upward to the west side of Yonge Street, at which point they reach an elevation of plus 3.19. At this point, in order to get under the Yonge Street sewer and to provide space on each side of this sewer for any possible future sewers, it was necessary to drop these lines to an elevation of minus 5.52 and run at this elevation under Yonge Street for a distance of approximately 70 ft. On the East side of Yonge Street they again rise to an elevation of plus 2.7 and from this point to the Scott Street plant they gradually rise entering the plant at an elevation of plus 3.25.

These lines run part way in re-claimed ground. This, together with the nearness of the lake and their elevation, not only made installation difficult, but also necessitated the selecting of a conduit which would be as nearly water-tight as possible. In addition to this it was felt necessary to use conduit which, if it did not prove absolutely water-tight, would carry off freely any moderate seapage so that no water should come in contact with the insulation on the pipes and so that radiant heat from the pipes would not come in direct contact with the water, thus causing condensation and ultimate deterioration of the insulation.

The type of conduits selected for the entire run, except the 70 ft. under Yonge Street, consists of a concrete base on which are laid two rectangular vitrified tile lines with open joints at top and sides, these vitrified tile being provided to carry away any possible seepage of water. The pipes after being insulated are supported on expansion rollers set on a roller base which rests on the tile, heavy half-round steel plate being placed between the rollers and the insulation. After the completely insulated pipes were set in position, corrugated galvanized iron forms were placed over them, over which concrete was poured to complete the sides and top of the conduits. Super cement was used to obtain waterproof concrete. Expansion joints, filled with sarco putty, are provided in the concrete about 25′ apart. As it was impossible to use this form of construction for the 70 ft. under Yonge Street, the lines were installed in a 42 in. round corrugated galvanized iron pipe set on a concrete base, and encased in concrete. Vitrified tile was installed in the bottom of this base set in concrete on which the pipes were supported in the manner described above.

The pipe used was extra heavy, strictly wrought iron, all joints being oxy-acetylene welded, except in expansion and anchor pits, where flanged joints were used. The pipes are insulated with two 1-in. layers of sponge felt sectional covering with joints broken both vertically and longitudinally, wired and cemented in position over which was applied a layer of heavy paper sheathing, the whole was then encased with 8 oz. canvas duck, sewed on, and painted two coats of waterproof paint. Expansion joints are provided approximately every 300 ft. with anchor pits midway between. In each expansion pit, double expansion joints of the guided type are provided which are anchored, permitting the pipe to expand towards same, from each anchor pit. The tile lines from the West side of Yonge Street to the building slope towards the building and any seepage carried through same is connected to a sump pump in the building. Any seepage in the conduit from the Power Company's Plant to the West side of Yonge Street is discharged into a sump pit located in the expansion joint pit at the West side of Yonge Street. Conduits and wires are run from the building to the sump pumps, one for carrying wires for operating the pumps, the other for carrying wires for a high water alarm which is installed in the building. These lines are designed to carry steam at a pressure of from 125 to 175 lbs. per square inch.

Interesting Information

The total estimated steam used per year in both sections of the building, in the train sheds and in the spaces in connection with the track development is 93,750,000 pounds. The total maximum demand of steam per hour is estimated at 54,000. Of this amount 9,700 pounds is for the East Wing. It is estimated that 15,000 gallons of hot water for domestic purposes will be used per week in the East Wing with a maximum demand of 350 gallons per hour. In the Main Building and spaces in connection with the track development, the estimated quantity of domestic hot water is 200,000 gallons with a maximum demand of 3,000 gallons per hour. The estimated total kilowatt hours per year of electrical energy for the Main Building, including the train sheds and spaces in connection with the track development, is 3,275,000. The estimated maximum total load in kilowatts for motors, other than electric elevators, is 347, for electric elevators 75 and for lighting 225. For the East Wing the total estimated kilowatt hours per year for all purposes is 750,000. The estimated maximum total load in kilowatts for lighting is 110 and for power 125.

There are approximately 55,000 sq. ft. of direct radiation and 21,500 sq. ft. of indirect radiation installed in the entire building; there being a total of 950 radiators. There are approximately 35 miles of pipe installed, including the high pressure steam lines. Of this amount approximately 4 miles are brass pipe. There are approximately 75 miles of electric conduits and 125 miles of wire. This amount of wire does not include that installed by telephone and telegraph companies, or the railroads and Public Works Department for miscellaneous services.

There are approximately 160 tons of sheet metal used in connection with indirect heating, supply and exhaust ventilation. There are 12 supply fans, handling a total quantity of air of approximately 232,000 cu. ft. per minute, and 14 exhaust fans handling a total quantity of air of approximately 180,000 cu. ft. per minute. There are 135 motors in the building, ranging in size from 1/8 to 35 horse power; 45 of these are in the East Wing. There are approximately 3,500 ceiling lighting outlets, 100 bracket lighting outlets, 650 base plugs and 900 switches in the building.

The Canadian Pulp and Paper Industry*

Statistics of the pulp and paper industry in Canada, historical development in the Dominion, a summary of processes for production of wood pulp, problems to be solved by the industry.

T. Linsey Crossley, A.M.E.I.C.

Advance Proof of Paper to be Presented at General Professional Meeting, Toronto, February 3rd, 1921.

There are two very good reasons for emphasizing the paper industry before *The Engineering Institute of Canada* assembled in a general meeting.

First — it is indigenous, and Canada is one of the few nations in which the manufacture of paper from wood pulp can be indigenous.

Second — its development and maintenance call for the display of great engineering ability. Structural, hydraulic, electrical, mechanical and chemical engineering are all involved, and another branch of engineering but lately evolved and largely functioning as a result of this industry, — forestry engineering. An important part is played by the forestry engineer in protecting the forests from fire and transporting the logs to the mill.

Our forests have many enemies from the careless camper to the carefree caterpillar. The former should be "beaten with many stripes" for he knows better. A forest is one of those things of beauty which may not be a joy forever. It may become an ash pile over night, or an aggregation of worm ridden joss sticks between seasons. Fungus and budworm and blister take their toll continually, and throughout the timber limits the forest engineer holds the front line trenches of a war between brains and bêtes noires.

The best pulp wood limits yield about five cords to the acre, and it takes one and a half cords of wood to produce a ton of paper. Canada has about 350,000 square miles of pulp wood capable of yielding about 1000 million cords, which we are now using at the rate of about 3¼ million cords annually. If the paper industry alone depleted the forest, our supply ought to last 300 years at the present rate. Forest fires, however, destroy more pulpwood than all the manufacturers put together, and there are in addition the forces of decay. The best wood for pulp is spruce, and it takes about 100 years for a spruce tree to mature.

Canada has an estimated water power development of about two million h.p. of which about 360,000 (360,858) or about 18% are employed in the production of pulp and paper. In addition there are used nearly 200,000 h.p. (183,384) of steam driven electric motors, 60,000 h.p. (56,660) in steam engines and over 3000 h.p. in gasoline, compressed air or other powers, or a total power use of about 600,000 h.p. and this is now being very largely increased. A ton of paper requires about 100 h.p. in its production. The per capita use of paper is about 125 lbs. in the United States, and as Canadians are not so wordy and have not yet acquired as a national failing the Sunday paper we may consume about 100 lbs. per capita, which is about the consumption in the United Kingdom.

History of Paper Manufacture in Canada

Paper was first made in Canada at St. Andrews, Quebec, in 1803. In 1825 a Mr. Crooks of Crooks Hollow won a prize of 100 pounds given by the Government of Upper Canada for the first sheet of paper made in Upper Canada, beating by a few days only, Messrs. John Eastwood and Colin Skinner in a mill on the Don River near Toronto. In 1840 the Taylor Brothers built a mill in the same neighbourhood and later two others, one of which is still in existence as the Don Valley Paper Mills. In 1853 the Barber family at Georgetown came into the industry and their mill is still in operation as the Barber Division of the Provincial Paper Mills. The Riordon Company was established in 1857 and ten years later they built a mill with a daily capacity of ten tons of news and wrapping paper, at that time one of the finest mills in America.

In 1866 the firm of Angus Logan and Company established a mill at Windsor Mills, Quebec, employing sixty persons. This is now the Canada Paper Co. In 1881 the census shows that Canada had five pulp mills capitalized at $92,000., employing sixty eight people and having an output of $63,000 annually. In 1901 there were twenty five mills with a capital investment of $11,500,000 ($11,558,560.) employing 3300 people and having an output valued at $4,246,000. (4,246,781.). The most recent completed figures are from 1918 and show:—Mills, 94; Capital, $241,344,704; Employees, 26000; Output: Pulp, 736,609 tons, valued at $41,302,882; Paper, 967,724 tons, valued at $76,700,913. In 1890 Canada's pulp and paper exports were valued at $120. In the year ending March 30, 1920, they exceeded $104,000,000. Canada's exports of pulp and paper to the United States made exchange at the rate of over $340,000 for every working day in the year.

Wood is prepared for paper making either by mechanical grinding or by chemical disintegration. In all cases the preliminary process of logging and removal of bark are identical. The wood is barked either in the log or in four foot, three foot and two foot blocks. When cut into blocks the log is hauled horizontally up an inclined plane against saws set usually in the form of a triangle, the two saws at the base cutting off the end blocks, the next two cutting the adjacent blocks, the one saw at the apex cuts the two middle blocks and the whole log, cut into blocks rolls off into the log conveyor. The saw table is called a slasher. Some slasher outfits exhibit great ingenuity and run almost automatically. Barking until recently was done by pressing the two foot block against a steel disc revolving in a vertical plane. For economy the blocks must be cylindrical. Gum seams and crookedness cause waste of useful wood in excessively deep cutting. The barking drum was evolved to eliminate this waste. It is a large cylinder about eight feet in diameter and twenty feet long, which is hung in, and rotated by chains. The inner sides of the drum are angle irons spaced a few inches apart parallel to the axis. Recent models have U shaped members in place of angle irons. The blocks or logs rolling over each other and against the sides of the drum, are gradually cleared of bark which falls through the spaces between the bars. The logs or blocks are stored in large piles which represent a large capital investment and serious fire risk. These block piles are now protected by some form of sprinkler system.

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Mechanical Wood Pulp

Blocks are ready for the mechanical process, but must be chipped for chemical treatment. Mechanical pulp is prepared by pressing the wood against the face of grindstones revolving in a vertical plane. The stone is encased in a casting having pockets, usually three, equally spaced on the upper half of the circumference of the stone. The bottom of the pocket is the face of the stone and the top is a flat casting attached to the piston of a hydraulic press. The blocks are fed into the sides of the pockets and rest horizontally on the stones. The stones are usually direct connected to water wheels and take about 500 H.P.

The output varies in quality and yield as a result of several conditions, gate opening, pressure on blocks, condition of stone face, and speed.

The stock is freed from the face of the stone by flushing with water; if much water is used the stock is said to be "cold ground". In most cases the amount of water is restricted, causing the pulp to leave the stone hot, this is called "hot grinding" and produces a more satisfactory pulp for newsprint.

The pulp coming from the stone is screened on a "bull" screen to remove large splinters and butts; these are of varied pattern and have openings large enough to permit very free passage of stock, which later passes to other finer screens after running over riffles to catch fine dirt and sand. The finer screens are flat in most cases, and consist of flat plates with fine slits about 0.01 of an inch wide by 2½ inches long. These plates are set in a platform which is constantly agitated in a vertical direction, being supported by short pillars resting on a series of slight projections on a shaft beneath it. The fine fibres are flushed and shaken through the screens, while splinters (called "shives") and fine dirt are held.

The pulp is now highly diluted with water and in many cases has to be thickened by removal of water before further handling. After this it is ready to use when mixed with a little chemical pulp for newsprint, which is 80% ground wood and 20% sulphite chemical pulp. It is also ready for sale to other mills. For this purpose it is run out over "wet" machines, which consist of a vat in which a cylinder covered with wire cloth revolves half submerged. The water runs off through the cylinder; the pulp is held like a mat on its surface. At the top of the revolution, it is taken off the cylinder by contact with a felt covered roll. This felt cover is part of an endless felt which conveys the pulp to a pair of rolls. The uppermost, a wooden roll, takes the pulp off the felt and it accumulates in successive layers on the wooden roll. When a sufficiently thick sheet has accumulated it is cut off by the operator with a pointed wooden stick and folded. It is sold in this form and called wet laps, being about 40% air dry pulp and 60% water.

Air dry means in the trade a pulp containing 10% moisture, and all pulp is sold on this basis.

Chemical Wood Pulps

(a) Sulphite
(b) Soda
(c) Sulphate (or Sulphur Soda)

In all these cases the wood, after barking, is chipped by placing the two foot or four foot blocks in a chute at an angle of about 45 deg. to the face of a large revolving disc in which knives are set somewhat tangentially to get the right direction of glancing cut.

The chips are screened to a size about ¾ inch long and ¼ to ⅜ inch thick and of varying widths to about two inches, the main consideration being the length which is the direction with the grain of the wood. The fibres, with the exception of the few ray fibres are in the direction of the grain and the cooking liquors penetrate the chip from the ends rather than from the sides.

The cooking in all three cases is done in stationary vertical cylindrical vessels with cone or cigar shaped ends called digesters.

In Europe some wood pulp is cooked in horizontal and vertical revolving digesters, but there are few if any in America. These were of the type known as "Mitscherlich" and cooked a fine white easy bleaching pulp by a long process and low pressures.

For the sulphite cooking liquor, which is acid and attacks the steel shell, a special brick and cement lining is used in the digesters, but this is not necessary in the sulphate and soda processes where the liquor is alkaline and does not attack the shell.

(a) Sulphite Process:—

(1) Acid cooking liquor:—in this case a solution of bisulphite of lime is prepared by passing sulphur dioxide gas into the base of a tower (or towers) filled with limestone into the top of which water is entering, this streaming down over the limestone meets and dissolves the ascending gas. The sulphur dioxide gas is prepared by burning sulphur in revolving burners. The gases are cooled before entering the towers, to a temperature of about 100 deg. F. If insufficient air and too high temperature conditions arise in the burners, the sulphur is

sublimed and when the gases are cooled the sulphur is condensed and chokes the system. The solution of sulphurous acid attacks the stone, forming sulphite of lime. The water and sulphite of lime solution dissolve more gas before the liquor leaves the base of the tower through a water seal, and thus there is formed a solution of bisulphite of lime with an excess of sulphur dioxide. This solution is not satisfactory for cooking purposes until it is enriched by some of the sulphurous acid recovered from the cooking process.

(2) The cooking process: — The chips prepared as described before are usually conveyed to hoppers over the tops of the digesters from which they are discharged into the digester. The digesters, which have to be lined with acid resisting brick, may be as large as fifteen feet in diameter and fifty feet high, containing twenty to twenty-five cords of chips and yielding about twelve to fourteen tons of air dry pulp at a cook, which takes about nine hours.

The acid cooking liquor is admitted at the bottom of the digester (in recent installations) until the chips are covered. All pipe and fittings for acid are made of acid resisting bronze. Steam is admitted also at the bottom, directly into the mixture of acid and chips. There is a good deal of condensation and this dilutes the acid, especially in the winter, hence efforts have been made to cook by indirect steam, but so far without success in the sulphite process, the corrosive action of the acid being difficult to cope with in efficient heat exchangers.

The pressure is raised slowly to about 70 lbs. At this point a relief valve is opened at the top and the accumulated air and gases are blown back through coolers into the acid recovery system being used to enrich fresh acid liquor. The relief at the top aids in getting a circulation of liquor and chips. The top relief is closed and pressure maintained for some hours until a temperature of 140 to 150 deg. C. is reached. There are occasional reliefs from a valve a little below the top and this controls the temperature and gas pressure. Effort is made to keep the sulphur dioxide as long as possible in the liquor. It is liberated from solution by the high temperature and when conditions make it necessary, it is blown back into the acid making system. When the liquor taken from a sampling cock in the digester has a dark brown colour and burnt sugar or caramel odour the cook is judged to be finished. Practice varies in different mills and with different men. There is still much of mystery with some men, reminiscent of the earlier days when secrecy and rule of thumb prevailed.

When the cook is completed, pressure is partially relieved to save gas as far as possible, and then the digester is blown down into a cement vat with perforated bottom called a blow pit wherein the pulp is washed and drained before passing out to a system of screens and riffles much the same as in the case of ground wood, being finished as wet laps, or stored in tanks. If it is to be shipped it is frequently run over a Fourdrinier machine, and obtained in rolls or sheets practically dry (about 10% or 15% moisture).

(b) **Soda Process:—**

(1) The cooking liquor: — This is a solution of caustic soda, and it is obtained by use of the reaction between quicklime and soda ash, in other words caustic lime and carbonate of soda. This reaction produces carbonate of lime, which being insoluble is precipitated and settles out as a sludge. The solution of caustic soda is syphoned off the sludge and the sludge filtered and washed. Settling of sludge, filtering and washing take time and require much tank capacity and many devices have been used to economise in these operations. The well known Dorr classifiers and thickeners similar to those used in mining concentration and sludge operations, are being used successfully, though it is claimed they are wasteful of heat. In some cases, agitation, settling and washing are done in the simplest way and the lime sludge eventually thrown away. In other cases even the lime sludge is dried and calcined in rotary kilns producing quicklime to renew the cycle, though in time the lime loses efficiency from accumulated impurities and fresh lime added.

The clear caustic soda solution is run to storage and used for cooking.

(2) The cooking process: — This is carried on with chips and liquor in digesters of the same type as those used for sulphite, but they do not have to be lined with the acid resisting brick, there is no volatile gas to recover and the cooking is simplified. The digester is brought up quickly to a pressure of about 125 pounds and is kept at that pressure about five hours, the whole cook takes 6 to 8 hours. Pressure is relieved occasionally to induce circulation where direct steaming is employed.

Many devices for circulation have been tried. Indirect steaming has been successfully introduced by the Morterud process. The principle of this process is to withdraw liquor from the bottom of the digester, pump it through a tube heater and back into the top of the digester, thus coping with the circulation and condensation problems at once and producing more uniform conditions in the digester.

The digester is blown into blow pits and the pulp is drained out and washed, but the liquor, called "black liquor" together with the washings up to a certain point are saved to recover the soda. The pulp is handled as in other cases.

(3) Recovery of Soda: — The black liquor drained from the blow pits together with some of the first washings (later washings being used for first washings on succeeding cooks.) is evaporated in quadruple effect vacuum pans to a heavy syrupy consistency, and then runs into a rotary furnace where with the aid of a little outside fuel, (slabs etc. being burned in an auxiliary furnace to start combustion) it burns as the water is finally driven out. Eventually soda ash, called "black ash" is delivered from the rotary burner. The black ash is leached out giving a solution of sodium carbonate. There is always a loss of about 10% of the soda in the cycle of operations, which must be made good by additions of fresh soda ash. The solution is now ready to begin the cycle again with the quicklime. The lime treatment is called causticizing.

(c) **Sulphate Process:—**

This is very similar in principle to the soda process. The name comes from the fact that sulphate of soda (salt cake) is used to replace the losses incidental to cooking and recovery.

The introduction of the sulphur in the sodium sulphate, however, materially affects the results. In the rotary furnace, not only is sodium carbonate produced, but a certain amount of sodium sulphide, also due to the fact that the cooking liquor contains 5 or 6% of sodium sulphate in addition to caustic soda. Sodium sulphide melts at a low temperature, so the ash does not run out of the rotary as a dry granular compound, but in a molten state, requiring a modification of the delivery end of the furnace. The melted salts flowing from the furnace run into tanks, directly and are thence taken when dissolved for causticizing with lime.

The vapours from digesters and blow pits contain a small amount of one of the most disagreeable smelling substances known, methyl mercaptan with other organic sulphur compounds. These produce the familiar atmosphere surrounding a sulphate mill. Their effect in such high dilutions is more psychological than toxic.

Paper Making

Much of the general principles are readily available, and would require too much space for the present purpose. It may be pointed out, however, that the whole industry is in a transitory state from an art, more or less hemmed in by tradition, to an industry controlled by science. The recent demands for quantity and speed of production have led many mills to defy the traditions.

The industry is essentially an engineering one, and in twenty years has developed great modifications, not so much in principles, as in mechanical effects. The Fourdrinier machine which for nearly a hundred years remained practically as it was invented, has recently been subjected, in the Harper modification, to a reversal of direction of flow on its wet end, which with changes in felts constitutes a notable improvement for such light stock as tissue, which is being so largely used.

The development in speed and quantity is shown in news paper. Twenty years ago a hundred and twenty inch machine, that is a machine making a continuous sheet of paper of that width was a large machine, and 600 feet a minute was fast. Today 200 inch machines and 900 feet a minute are installed in many mills, and at least one Canadian mill will put in a 240 inch machine for a speed of 1000 feet.

The design of such machines calls for application of a high order of engineering ability. The journals, and bearings of the huge steel drying cylinders of twenty foot span and 48 inch diameter which have to provide inlet for steam and ejector for condensed water must be well made to survive the stress. The heavy press rolls call for special design and a pronounced sag must be cared for by well calculated crowning of the rolls.

One case in the writer's knowledge called for a crown of ¾ of an inch on a 200 inch machine. The roll was a rubber covered steel roll. That meant an extreme bending of over an inch allowing something for compression of the hard rubber coat.

The problem of fatigue in the metals under these conditions is yet to be solved. The question of ventilation in paper mills has been well treated recently in a paper and discussion before the Montreal Branch*.

In hydraulics the coefficients of friction in pipes and flow boxes, with the stock containing varying percentages of pulp and other materials used as constituents of paper, presents another phase to be considered scientifically.

These general observations will, it is hoped, indicate what a field there is for engineering consideration in the Canadian Pulp and Paper Industry.

For the historical and statistical data used, the writer is indebted to "A Handbook of the Canadian Pulp and Paper Industry", by A. L. Dawe, Secretary of the Canadian Pulp and Paper Association.

Raw Materials for Pulps, and Kinds of Paper Made

Ground Wood —

Raw Materials — Woods—Spruce, with a little Balsam and Hemlock. Experiments indicate that Birch and Maple might be used.

Paper — About 80% of news print, boards, and many cheap printing papers.

Sulphite —

Raw Materials 1—Woods—Spruce, several varieties, Balsam, Hemlock, Jackpine. Poplar can be used, but needs special treatment.
2— Sulphur.
3— Limestone.

Papers — Book and writing papers, lighter wrappings, bags, and manillas.

Soda —

Raw Materials 1—Woods—Chiefly Poplar, also Spruce.
2— Soda Ash.
3— Quicklime.

Papers — Used in conjunction with sulphite in Book and Magazine papers.

Sulphate —

Raw Materials 1—Woods—Almost any kind, including slabs and mill edgings.
2— Salt cake (Sulphate of soda)
3— Quicklime.

Papers — Wrappings, manillas, container linings, and other uses where its brown color is not objectionable.

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*Heating and Ventilation of Paper Machine rooms, By Edward A. Ryan, A.M.E.I.C., read before Montreal Branch E.I.C., 18th November 1918. Journal E.I.C., Jan. 1921, Page 21.

Chemical Engineering in the Packing House*

Conditions governing packing house processes, curing meats, commercial use of by-products, opportunities for the mechanical and chemical engineer.

J. Richardson Donald, B.A., B.Sc.

Advance Proof of Paper to be Presented at the General Professional Meeting, Toronto, February 3rd, 1921.

The perishable nature of the product and the number of by-products found in the packing house industry offer a large scope for the application of chemical engineering principles. It is not the intention of this paper to try and outline the work of the chemical engineer in this industry but rather to give a summary of the general processes met with and to point out some of the defects in these processes or methods of dealing with various materials.

The modern packing house has sprung from the old fashioned butcher establishments which may still be found in rural districts. From these establishments to the modern plant where every effort is made to recover by-products is a great development. Coincident with the growth of the industry has come the realization that packing is a manufacturing industry differing only from others in that the raw material comes to the plant on the hoof. The successful superintendent of these plants is usually a trained mechanical or chemical engineer or a graduate in the hard school of experience where he has become familiar with the necessary technical details.

In contrast to most industries the raw product as received at the plant offers little scope to control from the engineering or chemical standpoint. Once, however, the animal is killed and the biological processes of decomposition start the various operations lend themselves particularly to chemical control.

After the hog is killed it is necessary to remove the hair from the carcass. This is done by first scalding the carcass and then passing it through a dehairing machine. In this machine the carcass is rapidly rotated on an axis running from its head to its tail and while being thus rapidly rotated is continually struck by short pieces of leather belting which pull the hair from the carcass. The temperature of the scalding vat should be controlled by a thermostat as over scalding ruptures the skin. These dehairing machines are fairly satisfactory but expensive to operate and are open to much improvement. The hair itself is either converted to fertilizer or washed with a soda solution, cleaned and dried. It is then used as a substitute for horse hair in stuffing cushions etc. and is a valuable by-product selling at about 7 cents a lb. As a fertilizer its ammonia content gives it its value.

Immediately life is extinct the putrefactive processes commence. It is essential that these be so controlled that the meat reaches the consumer in a satisfactory state. The first step towards this is to cool the carcass as rapidly as possible from blood temperature to a point where the decomposition forces chemical and bacterial are either stopped or so retarded as to be inappreciable. Decomposition takes place rapidly at temperatures approximating blood heat and the more rapidly the carcass can be chilled the better the keeping qualities of the final product. On the other hand it is essential that in cooling no part of the carcass be frozen. This limits the lower temperature of the cooler to 32 deg. Fahr. The problem therefore is to cool say 1000 hogs or an equivalent in cattle from blood heat to 34-38 deg. Fahr. in about 24 hrs. this temperature being taken at the centre of the meat. The details of the various refrigeration systems employed are well known and do not call for comment. There is to be considered here, however, one of the many factors involving loss to the packer. In cooling the large volume of product handled in the coolers and holding them at freezing or lower a large volume of air has to be circulated through the cooler. This involves the danger of a heavy shrink in weight if the humidity of this air is too low. On the other hand an excess of moisture means precipitation of moisture on the carcass and a more rapid deterioration than if the surface is keep dry. The meat becomes covered with mould and the cooler is more unsanitary than if dry. It is important that these factors be so controlled that the shrinkage in weight is reduced to a minimum and the quality of the product kept at its best.

The curing of meats, particularly pork products has become a large part of the packer's business, and comes under the particular care of the chemical division. The curing of meats is essentially saturation to such an extent with salts that after curing is completed the putrefactive agents are so controlled that the meat will keep for a longer or shorter period at ordinary temperatures without refrigeration. The curing process consists in most instances in immersing the meat in a pickle of predetermined strength and holding it in this brine until the cure is completed. The penetration of the salts throughout the meat is gradual and curing has to be carried out at a temperature between 32 and 40 deg. Fahr. in order that decomposition may not start before curing is completed. The length of time required in curing varies with the size of the piece and the cure required. The time may be six to eight weeks or only two weeks. A process has been devised in which the curing is carried out under pressure. This shortens the length of time required for curing and other advantages are also claimed. It can be readily appreciated that a process which will shorten the length of time required for curing and thus reduce carrying charges is a distinct gain.

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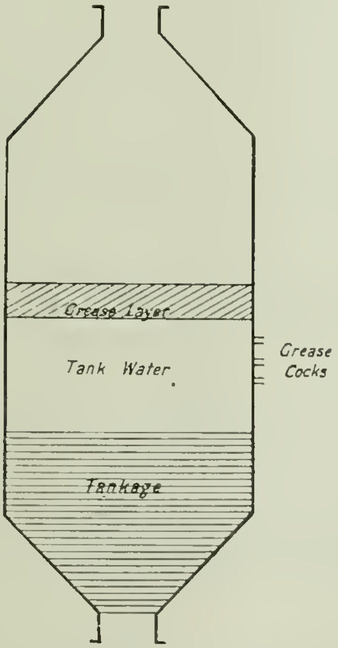
Plain pickles or pickles made of salt and sodium or potassium nitrate may be re-used after the salts absorbed by the meat in curing have been replaced. In the case of sweet pickles, that is pickles containing sugar in addition to salt and nitrate the re-use of the pickle without further treatment is undesirable owing to danger of fermentation of the sugar. To recover this pickle and save the sugar it is necessary to sterilize the solution. Due to the protein matter dissolved in the used pickle which coagulates fairly readily sterilization must be brought about by bringing the solution as rapidly as possible to sterilization temperature and then cooling quickly. If these points are not watched and coagulation takes place the coagulated matter settles on the heating coils, chars and discolours, rendering the pickle useless.

Most cured meats are smoked. Smoking assists curing by drying out the excess surface moisture and by giving the finished product the smoke flavour. It is not unlikely also that the slight deposit of creosote on the surface of the meat retards bacterial decomposition. As in other processes the shrink in smoking must be carefully controlled.



Section of Rendering Tank

All fatty products not sold for human consumption find their way to rendering tanks where the fat is rendered out of them. These rendering tanks consist of cylindrical shells 6-10 ft. long equipped with cone bottoms and dish or cone shaped heads. The fats and scraps are loaded into these tanks and when about ¾ full they are closed, steam pressure turned on and they are cooked for a given length of time, depending upon the size of charge etc. When cooking is completed the tank is allowed to settle and three distinct layers are obtained. At the bottom will be found the meaty or protein matter from which the fat has been extracted, above this the tank water containing soluble meat extracts, and on top of this the grease layer. This grease is drawn off through suitably placed cocks, the grease layer being raised or lowered to the level of the cock by the addition or withdrawal of water. It is important that all the fat or grease possible should be obtained at this stage, and the work requires a skilled operator. The difficulty of drawing off the last trace of grease from the surface of the water without also drawing water will be appreciated. To overcome this difficulty and to make the drawing off of the grease an automatic process a simple yet effective device termed the Bannon Separator has been worked out by E. W. Thorold, M.E.I.C. The following diagram illustrates its operation.

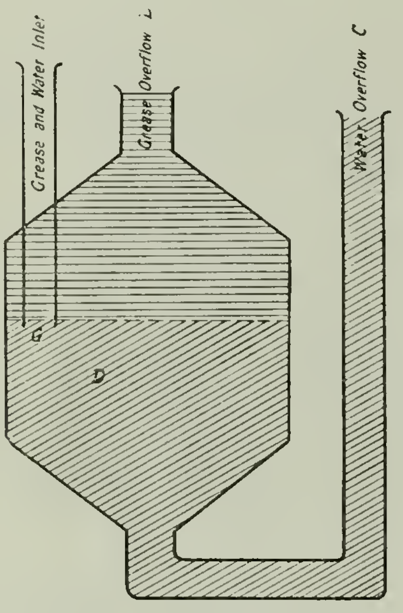
The mixture of water and grease enter the separator at A and flow into the chamber at G coming into contact with the water D placed in the separator as a priming charge. The mixture of grease and water gradually separate out, the grease rising to the surface. As the process continues and the separator becomes full the grease overflows at B and the water at C. A steady flow of grease and water then takes place as the mixture is fed to the separator. The levels of B and C are slightly different the difference being based on the difference in sp. gr. between the liquid grease and water. The usual size of the separator body for use in rendering plants is about 3 ft. in dia. by 3 ft. in height.

The extension of the principle to large volumes of oil and water or of water containing a small percentage of grease as tank water would save much labour at present employed in skimming. To do this would require a separator much larger in size than that described and capable of holding a large volume of water.

There still remains the tankage and tank water to be dealt with. The tank water as drawn from the rendering tanks contains four to five per cent of solids in solution. These solids are of a gelatinous nature really a meat extract. The water also retains about 100 ozs. of fat per 100 gals. of water, this latter being present as an emulsion. To recover this fat the water is conducted with as little agitation as possible to large settling tanks where the fat gradually rises to the surface and is skimmed off by hand ladles. The recovery of this fat as at present conducted is a laborious matter. The water must be kept hot otherwise it ferments and is lost. The skimming by hand possesses all the disadvantages of a process entirely dependent on the human factor. The loss of this fat means a loss of around 18¢ a lb., and it eventually finds its way to fertilizers where its presence is a disadvantage.

Various means of automatically and mechanically recovering this grease have been proposed but so far as we know centrifuging and the use of the Bannon Separator are the only two practical suggestions. The centrifuge loses its effectiveness owing to the presence of small solid particles in the water which must be filtered out. The Bannon Separator seems the most practical method devised.

The tank water after being freed from grease passes to vacuum evaporators where it is evaporated down till the water content is reduced to 50%. The sticky meat extract thus obtained is mixed in with the dried tankage and sold as a fertilizer material. The meat extract obtained by the evaporation of edible tank water, that is water from edible products, should be a highly nutritive product and some more satisfactory outlet than fertilizer should be found for this material. The evaporation of these large quantities of water require a large evaporative capacity which is supplied by triple or double effect vacuum evaporators. The greatest source of trouble in evaporators handling tank water is corrosion of the heating tubes usually made of copper or steel. An attempt has been made to correct this by the use of cast iron heating units after the design of a steam radiator. While these success fully resist corrosion it is difficult to clean the interior surface and as a result of tank water boiling over occasionally, from one effect to another, the interior of the heating units become coated and lose in heating efficiency.



Section of Bannon Separator

The solid matter in the bottom of the tank consisting of bones. protein matter and fibre remains to be dealt with. It still contains a high percentage of fat which must be pressed out and is saturated with water. As it comes from the tank it is conveyed to a hydraulic press and compressed to a pressure of 150-200 lbs. per sq. in. This reduces the grease content to about 6% figured on a dry basis, and the moisture to about 50%. The pressing is slow and laborious. The tankage is dropped on to press cloths made into cakes separated by racks, and when a set of ten or twelve has been built up the truck is run under the hydraulic ram and the pressure applied. About the best results obtainable are to reduce the grease content to 4% and often it is nearer 8%. The loading of the press is a slow operation and the work is trying. The cloths rot quickly under the effects of the organic acids in the tank water, and as they are worth $7.50 each and each press requires a set of ten this is a heavy item of expense. Continuous presses operating on the screw principle have been tried but they have not proved satisfactory. One of the difficulties is the condition in which the tankage is received at the press. At times the tankage is fairly solid and at other times or from different products it is a wet mush or like mud.

From the press the tankage goes to the dryers where the moisture content is reduced to around 8% and the material is ready for the fertilizer manufacturer. The dryers are of the indirect type heated with steam and equipped with agitators. The remaining grease content of 6-8% can only be removed by solvent extraction using gasoline or carbon tetrachloride. Both solvents are troublesome, the one being inflammable and the other poisonous. Given a satisfactory solvent free from these defects it seems probable that extraction plants would become more popular.

The very fact that this protein matter is sold as fertilizer together with blood and concentrated tank water represents a degradation of this material. It is essentially meat protein, and its ammonia content has to pass through the cycle of vegetable and animal life before it can again become a foodstuff. Moreover in the process of use as a fertilizer a great deal of its value is wasted. The proper utilization of this matter should be as a foodstuff not for human beings but for cattle, poultry, hogs etc. This latter development has been slow. The packer has failed to appreciate the possibilities of this field, and has been unwilling to take the precautions necessary to produce a material satisfactory to his consumers. At the same time the farmer have failed to realize the value of such concentrated foods.

In considering packing house processes the fact must not be lost sight of that the greater part of the packer's business is the marketing of meat products. However, without the conservation of his by-products meat products would not reach the consumers at as low a figure.

Undoubtedly a big field awaits the mechanical engineer in the packing house. A few points have been mentioned which have particularly struck the writer. In any packing house the mechanical engineer will see opportunities for labour saving devices. There is much scope for an inventive mind in rendering plants. The present process of rendering is inefficient but whether the improvements will be mechanical or chemical remains to be seen.

The chemical engineer will find scope for all his efforts in the question of conservation, both from an operating point of view and also from the standpoint of investigation. This latter is true not only from the standpoint of wastage but in developing uses for the various products which prevent degradation which is really the highest kind of conservation. A product should not be saved as a fertilizer if it can be saved as a food or feed.

Present Day Illumination Standards*

The relations between good lighting and increased efficiency, with tables showing results of better lighting in the factory.

George C. Cousins

Advance Proof of Paper to be Presented at the General Professional Meeting, Toronto, February 2nd, 1921

Artificial illumination is a product of civilization that permeates every branch of our activities and upon the success of its application depends, to a very large extent, the success of the activities carried on by its aid, especially in industry and commerce.

High intensity industrial illumination of the present day is in reality a by-product of the late world war. Previous to this, artificial lighting was considered very much as a crutch to assist industry over the dark periods of the day when work would otherwise have ceased out of sheer necessity. The economic value of illumination as a strong factor in production was not given serious consideration. The requirements of the war placed a most urgent demand upon industry that taxed its capacities to the utmost, with the result that night work was necessary and the short-comings of artificial illumination were keenly felt. This necessity furnished illuminating engineers with a more effective weapon, than any which had previously been available, with which to attack the problem of rendering night work really productive, and the results obtained are causing industrial managers to change their attitudes toward artificial lighting and they are now looking upon it as an asset instead of as a liability.

In planning the layout of machinery in factories the relative importance of daylight and artificial light is frequently not given sufficient study, with the result that machines are placed so as to utilize daylight under the best conditions. This arrangement often complicates the utilization of artificial light to the best advantage. Daylight has usually been considered satisfactory and has been used as a reference standard in the absence of real data on the actual conditions.

Surveys of daylight illumination in factories have revealed the fact that in many plants the natural illumination is inferior to good artificial lighting. The following is a typical example: A machine shop is built with practically continuous window area on south, west and north walls. On a clear cloudless morning measurements of intensities at the benches near the windows showed over 50 foot candles (ft-c.), while about 30 feet from the windows the intensities at the work points of machine tools ranged from 3 to 14 ft. c. In some cases artificial light was used to supplement the daylight. The shop under consideration was on the second floor of the building, there were no high buildings within several hundred feet and a clear sky exposure is obtained on all sides. This is a very favourable condition. Where buildings are grouped together so that the sky is obscured the conditions would be very much worse. A more extended study[1] of daylight intensities in 18 factories showed average intensities ranging from 1.5 to 10 ft. C. for lower grades of work and 4 to 18 for finer grades.

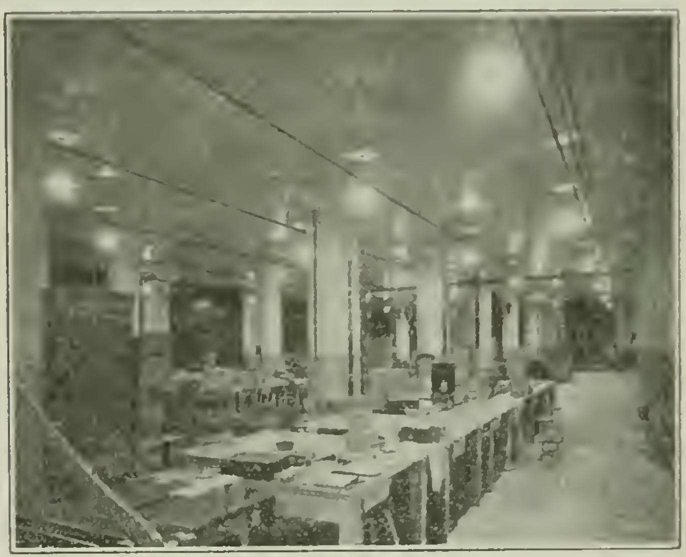


Figure 1

These results tend to show that daylight illumination in factories is not as good as is ordinarily supposed to be the case and that the distribution of daylight is far inferior to that of reasonably good artificial lighting. As a result of the knowledge of these conditions it has been proved that artificial lighting can be economically produced that is superior to daylight (Fig. 1), in both average intensity and distribution and that when the lighting system and the machinery or work spaces are properly co-ordinated the resulting illumination will have the greatest all-day effectiveness and manufacturing can be maintained on a really productive basis throughout the entire day.

For many years the conviction of illuminating engineers has been that factory output could be increased by the use of high intensities of illumination but the putting of this opinion to the test was a difficult problem and it required some strong action to break the ice of opposition.

A Convincing Test of Better Lighting

The problem was attached in a rather novel manner by the Commonwealth Edison Co. of Chicago[2]. Their engineers approached a number of manufacturers, at whose plants accurate cost records were kept, with the proposal to instal trial lighting systems to produce three times the intensities previously recommended for the various classes of work. Records of cost and output were to be kept for a month under the existing lighting systems, then for a month under the new and finally a reversion to the old systems for another month. This was expected to furnish reliable data on the unit cost of output. The results were so gratifying that all the trial systems were retained as permanent, and in some cases the manufacturers would not permit a reversion to the old systems, realizing that it would mean financial loss. Some of the effects of the high intensities were that the increase in production was from 10 to 20% with a maximum cost increase of 5.5% of the payroll. In one case the production was increased 15% with no increase in the cost. The increased economy is due to more work being turned out with a decrease in the amount of spoiled and defective work. The indirect beneficial results to the workers in the form of more cheerful surroundings, cleaner shops, less eye strain and fewer accidents react to the benefit of the manufacturer in keeping the working force in a more efficient and contented mood.

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A very important phase of the effects of high intensity is its effect on the accident rate. About ten years ago approximately 24% of industrial accidents[3] were caused by poor lighting, by improving the lighting conditions this percentage has been reduced to about 15%. The economic loss caused by these accidents amounts to approximately $300,000,000 per year in the United States, which is more than the yearly lighting bill. A graphic illustration of the relation of accidents to the use of artificial light is shown in Fig. 2. In the B curve the portions of the curve showing less than 12 hours of darkness are not relatively important and lines are drawn along the 12 hour obscissa to connect with the curve showing more than 12 hours of darkness. The resulting curve thus formed has a striking resemblance to the curve showing the relation of daylight to accidents.

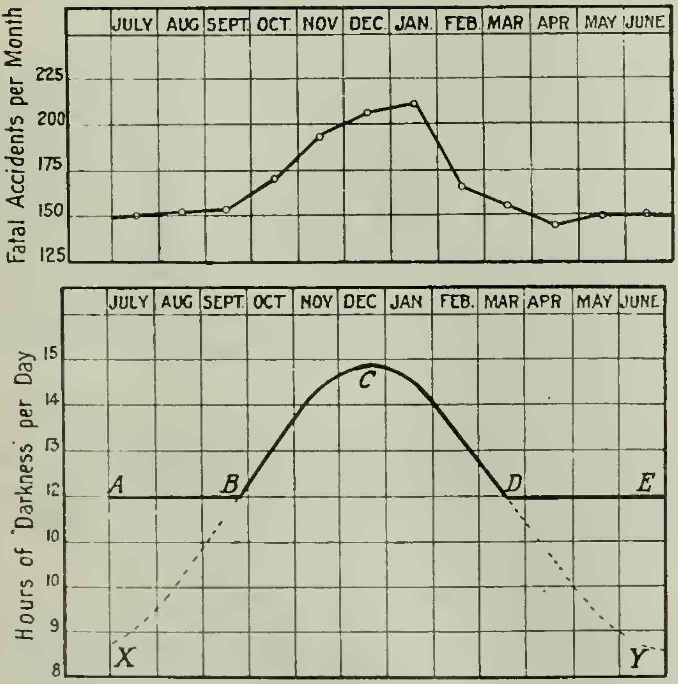

Figure 2

The relative importance of daylight and artificial light may be estimated from the fact that artificial light is used on an average of about 5 hours per day throughout the year. Figure 3. This is roughly about 50% of the working day and in view of this the importance of giving proper weight to artificial lighting is evident. When plants are operated at night the balance is overwhelmingly in favor of artificial light. Figure 3 shows the number of hours per day during which all the lamps of a factory were used in January and June.

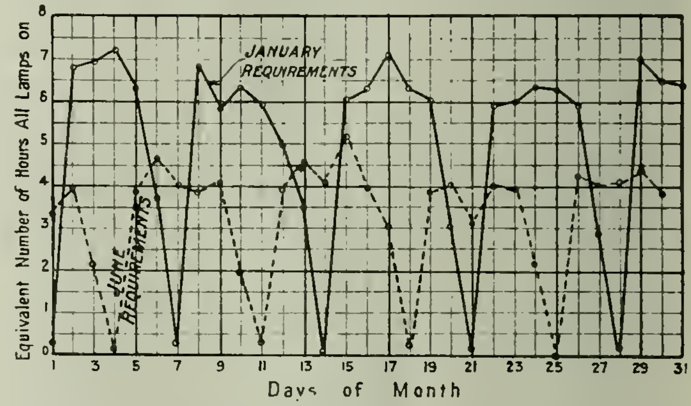

Figure 3

Number of hours per day during which all lamps in factory section were in use in January and June

Intensities of Illumination Recommended for Various Classes of Work, 1916.

	Foot-candles
Bakery	2.0– 3.0
Bench work:	
Rough	1.5– 5.0
Fine	3.5–10.0
Box factory	2.0– 4.0
Book binding:	
Cutting, punching, stitching	3.0– 5.0
Embossing	4.0– 6.0
Folding, assembling, pasting	2.0– 4.0
Candy factory	2.0– 4.0
Canning plants:	
Coffee roasting at tables	3.0– 4.0
Filling tables	1.0– 1.5
Packing tables	1.0– 2.0
Packingtables (dried fruits)	1.5– 2.5
Preserving cauldrons	2.0– 2.5
Pressing tables	1.0– 1.5
Shipping room	1.5– 2.5
Cotton mill weaving	2.0– 4.0
Paint shop:	
Coarse work (first coats	2.0– 4.0
Fine work (finish'g)	4.0– 8.0
Passageways	0.25–0.5
Pattern shop (metal)	4.0– 6.0
Pottery:	
Grinding	1.0– 2.0
Pressing	2.0– 4.0
Power house:	
Boiler room	0.8– 1.5
Engine room	2.0– 3.5
Preserving plant:	
Cleaning	2.0– 4.0
Cooking	2.0– 3.0
Printing:	
Presses	3.0– 5.0
Type-setters	6.0– 8.0
Sheet metal shop:	
Assembling	2.0– 4.0
Punching	3.0– 6.0
Shoe shops:	
Bench work	2.0– 5.0
Cutting	5.0– 7.0

	Foot-candles
Dairy or milk depot	2.0–4.0
Drafting room	7.0
Electrotyping	3.0–6.0
Factory:	
Assembling	4.0–7.0
Drills	2.0–4.0
Millers	3.0–6.0
Planers	3.0–5.0
Rough manufact'g	1.25–3.0
Fine manufact'g	3.5–6.0
Special cases of fine work	10.0–15.0
Forge and blacksmithing:	
Ordinary anvil work	2.0–4.0
Machine forging	2.0–3.0
Tempering	2.0–4.0
Tool forging	3.0–5.0
Foundry:	
Bench moulding	1.0–3.0
Floor moulding	1.0–2.0
Garment industry:	
Light goods	5.0
Dark goods	7.0
Glove factory:	
Cutting	5.0–6.0
Sorting	6.0–10.0
Hat factory:	
Blocking	4.0–6.0
Forming	3.0–5.0
Stiffening	2.0–4.0
Jewelry manufact'g	3.0–8.0
Knitting mill	3.0–6.0
Laundry	3.0–5.0
Leather working:	
Cutting	4.0–6.0
Grading	6.0–8.0
Meat packing:	
Cleaning	2.0–3.0
Packing	2.0–4.0
Offices	3.0
Packing and shipping:	
Ordinary work	2.0–3.0
Fine work	2.0–5.0

	Foot-candles
Silk mill:	
Finishing	3.0–5.0
Weaving	4.0–6.0
Winding forms	2.0–4.0
Stairways	0.25–0.5
Steel work:	
Blast furnace (cast house)	0.3–0.5
Loading yards (inspection)	0.3–0.5
Mould, skull cracker and ore yards	0.1–0.3
Open hearth floors (soaking pits and cast house)	0.1–0.3
Rolling mills	1.0–2.0
Stamping and punching sheet metal	2.0–5.0
Stock room	0.8–2.0
Threading floor of pipe mills	1.0–2.0
Transfer and storage bays	0.5–1.0
Unloading yards	0.1–0.3
Warehouse	0.5–1.0
Stock rooms:	
Rough materials	1.0–3.0
Fine materials	2.0–4.0
Storage	0.25–0.5
Wire drawing:	
Coarse	2.0–4.0
Fence machines	2.0–5.0
Fine	4.0–8.0
Wood working:	
Rough	2.0–4.0
Fine	3.0–5.0
Woollen mill:	
Picking table	2.0–4.0
Twisting	2.0–3.0
Warping	3.0–5.0
Weaving	4.0–0.6

Revised Estimates

The table given above shows the intensities recommended for various classes of work in 1916. A reference to a few of these might be interesting for the sake of comparison. Machine tools were listed as requiring from 2 to 6 ft. c., rough manufacturing 1.25 to 3, fine manufacturing 3.5 to 6, special cases of fine work 10 to 15, drafting 7. Compare these with some of the recent installations; for an aluminum working plant 14 ft. c., a drawn steel factory 15 to 16 ft. c., manufacturing automobile springs 21 to 22, ordinary machine shop work 10 to 11 and punch presses 6 to 10. These cases do not required particularly fine work and yet the intensities are equal to or greater than daylight intensities in many factories.

As far as can be learned all the installations of high intensities have resulted in economy and are considered good investments. How far high intensity can be carried before the limit of economy is reached is problematical but that limit has not yet been reached. It appears evident, however, that as intensities are increased the increase in economy will be by smaller increments and that the gain resulting from an increase in intensity of from 10 to 15 ft. c. would not be as great as it would from 5 to 10.

Considerable headway is being made in the elimination of drop cords. In some cases workers have clung so tenaciously to these that their removal has resulted in mutiny. In some operations they are indispensable, and to provide for such contingencies in up-to-date plants they are kept in tool check rooms and supplied as special tools being returned when the operation requiring them is completed. Experience has proved that there are very few industries that cannot be lighted quite satisfactorily by overhead units. Drop cords are relics of the early days when carbon lamps were the only suitable electric lamps for interior lighting, and should find no place in modern installations of high powered lamps in suitably selected and placed reflectors except in special cases where overhead light cannot reach the point where work is being done. The practical solution of the elimination of drop cords is the correct placing of lamps relative to the work places or vice-versa. In large plants of mill construction it is sometimes necessary to provide individual lamps for machine tools placed in open bays. In some cases flood lighting units placed close to the ceiling are suitable and for others an adjustable lamp with its reflector is mounted on the end of a pipe arm which can be adjusted horizontally through an unthreaded T which can in turn be raised or lowered on the end of a telescoping upright. By this means a substantial construction is provided without the dangers accompanying exposed insulated wire.

Colour Distinction

Aside from the strictly productive value of artificial light is the effect of its character on the selection and classification of materials and the detection of defects. The value of the colour of the light for these purposes is increasing, and many industries are making use of white light, or artificial daylight in certain departments. This is a very broad subject that can only be touched upon in this paper.

A few of the industries requiring colour distinction are as follows: paper, flour, paint, sugar, jewelry, tobacco, chemical, textile, colour printing and ore refining. There are different ways of producing daylight quality but the most common is by filtering some of the excess red and yellow from the light of gas-filled tungsten or from incandescent gas. A luminous gas lamp is also available which produces the required colour directly. The simplest and most commonly used is the gas-filled tungsten lamp with a blue bulb. These are made in three grades or density of colour to be used according to the accuracy of colour selection required. The first is known as C2 and is a compromise between noon sunlight quality and ordinary gas-filled lamp colour. Its principal use is for producing a daylight effect where accurate daylight quality is not necessary and efficiency is important. A light of the same color as noon sunlight is produced with a corresponding loss of efficiency by a lamp with a deeper blue bulb than the C2. This lamp is suitable for all but the most exacting colour perception for which a north-skylight lamp is furnished. These colour matching effects can also be produced by screens of suitably coloured glass fitted to reflectors in which are clear bulb gas-filled lamps. When selecting filters or lamps for any of the above mentioned purposes, it is necessary for the resulting light to have the proper distribution of light throughout the spectrum. Daylight effect can be produced by mixing two or more primary colours but its spectrum might be discontinuous, and it is easily possible to select two samples of similar colour that appear identical under continuous spectrum white that appear very different under synthetic white.

Coloured light, white or otherwise, can be used to show any colour in contrast to any other colour and the employment of this principle can be applied to many operations making what might otherwise require considerable skill and experience.

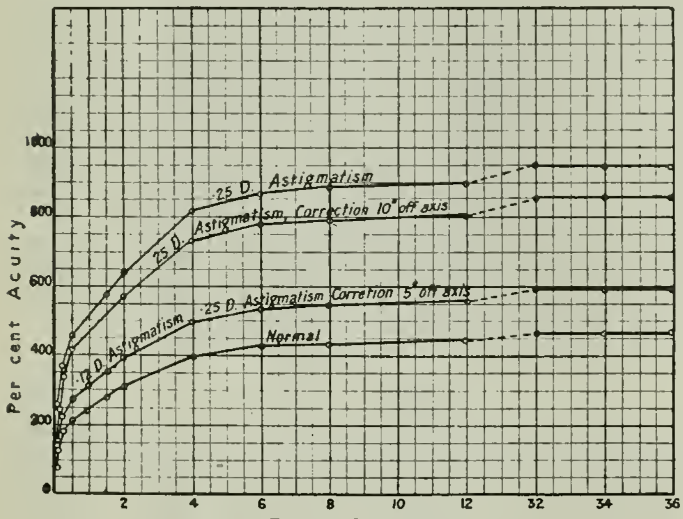

Figure 4

Curves showing the percentage gain in visual acuity with increasing illumination, for the normal eye and the same eye made slightly astigmatic.

Office Lighting

On account of the connection of offices with factories some of the improvement in the lighting of the latter has extended to the former. Office work as a rule does not require as high intensity as factory work but requires more refinement in the form of diffusion. One of the important factors in the success of office lighting is the elimination of bright reflections from furniture and paper surfaces. This has been very successfully accomplished by the use of semi-indirect and indirect fixtures. It has been found[4] that the eye suffers less fatigue under indirect than under any other type of fixture. The dense bowl semi-indirect unit gives practically the same illumination effect and the more dense the bowl the less eye fatigue is caused. Considerable improvement has been made in the design of semi-indirect bowls during the last few years. These are mainly in the way of dust proof units. Totally enclosing units can now be obtained that have all the good qualities of the open inverted bowls with the dust proof feature of enclosing globes. Some of these have reflecting domes above the bowls for use where ceilings are not suitable for use as secondary light sources and others have clear glass tops. Other fixtures are equipped with automatic cleaning devices operated by the same pull-chain that operates the switch. Every time the lamp is lighted or extinguished a felt squeegee makes a complete revolution of the interior of the bowl removing all dust.

About 5 to 10 ft. c. might be considered as representative of good office lighting at present although there are some installations of from 14 to 19 ft. c.

The period of transition from daylight to darkness when the fading daylight must be reinforced by artificial light has always been one of the difficult problems to solve. During this period the eye is attempting to work under two conflicting conditions. It is adapted to the colour of daylight and the introduction of the yellower artificial light disturbs its condition of equilibrium; comfortable vision is not obtained until artificial light dominates the situation and the eye becomes adapted. To reduce the annoyance of this period C2 mazda lamps have been found very successful. The colour of this light, nearly white, blends with the daylight and work can be carried on with very little interference.

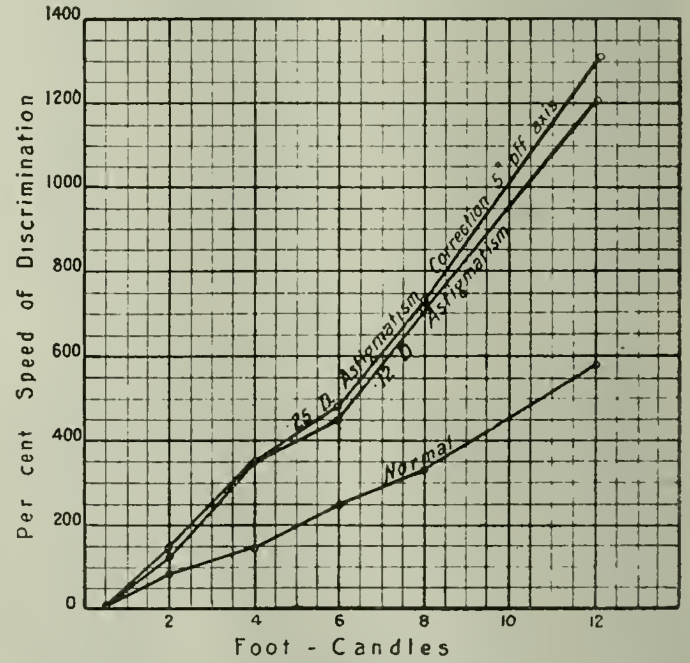

Figure 5

Curves showing the percentage gain with increasing intensity of illumination for a normal eye and the same eye made slightly astigmatic.

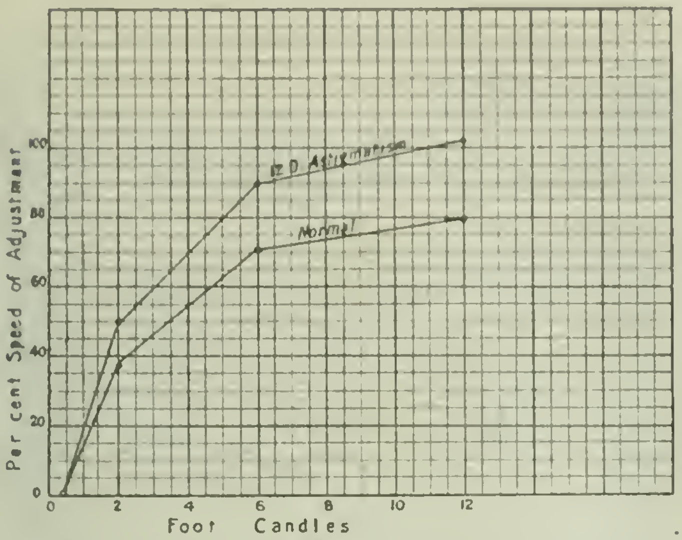

Figure 6

Curves showing the percentage gain in speed adjustment of the eye for clear seeing at different distances, with increasing intensity of illumination for the normal eye and the same eye made slightly astigmatic.

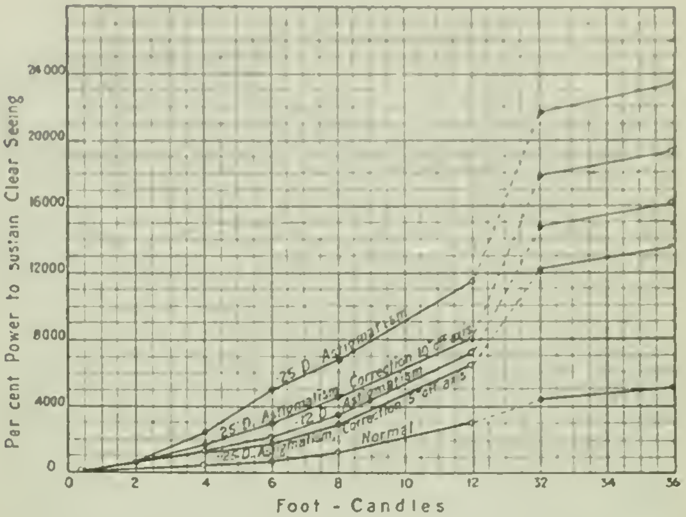

Figure 7

Curves showing the percentage gain in power to sustain clear seeing with increasing intensity of illumination for the normal eye and the same eye made slightly astigmatic.

Store lighting has not been noticeably improved during the last few years in spite of the great turnover of retail merchandise. Merchants are making good use of the attractive value of light in their show windows but in the stores where the selling and buying is carried on the general level of intensities is low. In a recent survey[5] of 25 of the large stores of the continent involving measurements of intensities at 163 sections it was found that at only 6 sections were the intensities 6 ft. c. or over and the general run of intensities ranged from 1 to 4 ft. c. Merchants have resorted to high intensities temporarily to induce increased sales in certain sections. Of course where light coloured goods are shown lower intensity will be sufficient than if the goods are dark.

The use of artificial daylight in stores is increasing. It has been found that general illumination by C2 lamps can be produced at a reasonable cost, this blends well with daylight and produces more satisfactory results than the unmodified tungsten light. For colour matching localized lighting of north skylight is supplied where needed.

In the foregoing only the monetary aspect of artificial lighting has been considered. The physiological aspect has been studied[6] showing the effect of intensity of illumination on the working of the eye. This investigation was conducted over a range of intensities from 4 to 36 ft. c. It was found that with increasing intensity a gain was obtained in visual acuity, power to sustain acuity, speed of discrimination and speed of adjustment of the eye for clear vision at different distances, figs. 4, 5, 6 and 7. These gains were greater for eyes with slight uncorrected defects than for normal eyes and there are indications that the middle aged and aged eyes are benefitted more than young eyes. The increase in acuity is very rapid up to about 5 or 6 ft. c. after which it becomes more gradual. The other functions of the eye that are effected by time shown a more gradual gain at lower values and more rapid at higher intensities. The power to sustain acuity of vision shows the greatest increase.

These functions of the eye all have a very direct bearing on the amount and quality of work that can be performed by an individual and the ease with which it can be done and a knowledge of their performance under varying intensities of illumination proves that increased production with increased intensity is based upon sound physiological facts and is the logical result. It also points the way for the conservation of the eyesight of the people and the elimination of the evils that have resulted in the past from prolonged use of poor lighting.

In view of the conditions under which high intensity lighting has been evolved, it is not surprising that the greatest improvement has been made in the industrial field. The value of high intensity has been firmly established from both the economic and hygienic view points and there are strong indications that we are in the threshold of a new era of artificial lighting that will include all branches of industry and commerce.

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Municipal Engineering*

A historical survey of various branches of municipal engineering, including water supply, sewage disposal and road construction, with tables of present day statistics relative to Canadian cities.

R. O. Wynne-Roberts, M.E.I.C.

Advance Proof of Paper to be Presented at the General Professional Meeting, Toronto, February 2nd, 1921

It will doubtless be admitted that the state of civilization in the early days of history was highly developed, indeed, in some respects, it has never been surpassed. The term Civilization is difficult to define. It includes such a great variety of ideas and its ramifications are so extensive. Spencer describes how tribes became communities, communities grew into cities and cities into states. Tolstoi traced the same line of thought but pointed out that many of these developments ended in death, indicating that civilization was not developed on permanent foundations. In the early days it was confined to a small proportion of the people. The great works of those days were carried out primarily for the glorification and benefit of the wealthy, and as it was then considered degrading to work, slaves represented about 75 per cent of the population and were forced to derive what advantages they could obtain through the grace of their masters. Conquerors frequently recorded their achievements by building structures which were to immortalize their names. It is noteworthy, however, that the great leaders of those days had sufficient wisdom and foresight to formulate certain laws and establish customs to provide for the welfare of the people, as will be shown later on. History records the rise and fall of many nations and civilization has passed through many stages of development and retrogression.

For about 1000 years after the fall of the Roman Empire, civilization was at a low ebb, but as was stated by Draper, human intellect at the close of the thirteenth century awoke from its sleep. We are not to suppose that men now possess more ability than in the earlier ages, but the printing press gave "immortality to their works, to diffuse throughout all the ramifications of society the knowledge that had previously been hoarded up by a few." Prior to the invention of the printing press and even for generations afterwards, "military glory made conquest the end of human ambition and of human happiness, and he who had murdered most, and burned most, and ruined most, and pillaged most, was the greatest man". After the press was introduced "men began to find out that there were ways to be powerful without the destruction of rivals and that to conquer Nature with her own weapons was the only mode to be truly great".

While we must acknowledge the agencies by which civilization was developed, it may be contended with some reason that its status and benefits may be judged by the condition of municipal engineering at the time. The term Municipal Engineering, as we know it, is relatively modern in its inception. It is less than a century old. But municipal works were constructed and sanitary laws were written in the early history of man. In the days when the Chaldeans were powerful and for centuries after, surveying was a sort of religious function and we are informed by Cassiodorus that Augustus "made a complete survey of the whole "Orbis Romanus", in order that each taxpayer should know exactly his resources and obligation". Clemens Herschel states that the Roman system of surveying was hardly inferior, in any respect to the best that now exists. Geometry, Euclid and arithmetic have passed on to us as a legacy from the misty past.

Water

Herodotus wrote that "the Persians do not defile the streams nor do they allow any one else to do so, but they pay extreme veneration to all rivers". This is somewhat different to our customs. Joseph's Well at Cairo is one of the ancient water works. It was excavated in solid rock 297 feet deep. The lower portion is 9 ft. by 15 ft. and the upper portion is 18 ft. by 24 ft., with a spiral pathway from the surface to the bottom. Water was raised by buckets on endless ropes. Dimension stone, brick and concrete were used in the building of aqueducts, dams and reservoirs in the Eastern countries, and some of the structures were examples of remarkable engineering skill. Frontinus, who was the Water Commissioner of Rome in A.D. 97 wrote a description of the great waterworks of that city, which was translated and published by Clemens Herschell, Past President of the American Society of Civil Engineers. Frontinus stated that for 441 years after the foundation of the city the Romans were content with the use of water from the Tiber or from wells or springs.

Nine aqueducts had been constructed in his time to supply water to each ward of Rome, capable of delivering about 45 million imperial gallons per day to the fountains, public buildings and the one million souls that lived there, and 25 million imperial gallons additional to the district outside the city. Frontinus described how the water service connections were made and recorded and how the art of measuring water by quinaria was carried out. This method was crude, but it was evidently the best that was then devised. The stealing of water was prevalent and caused considerable worry to this prominent official. The maintenance of these works was considered of such importance in Frontinus' days that he declared it to be a thing "which is worthy of special care as it gives the best testimony to the greatness of the Roman Empire". It is believed that there are about 200 ruins of such aqueducts which had been erected in the countries conquered by the Romans.

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Tunnels for water supply were then fairly common. There was one over three miles long on the line of the aqueduct in Antibes in France. Another was cut through rock to drain Lake Fucinus in Italy about A.D. 50, on which 30,000 men worked for eleven years. The length was about 18,000 feet. Mr. Herschel quotes interesting correspondence that took place in A.D. 152 which may be quoted in part. The first is from the Governor of Mauritania to the Governor of Numidia, colonies in Africa, asking "in the name of the township of Saldae to despatch at once the hydraulic engineer of the third legion, Nonius Datus, to finish his work". To which the engineer replied that "I found everybody sad and despondent; they had given up all hopes that the two opposite sections of the tunnel would meet, because each section had already been excavated beyond the middle of the mountain and the junction had not yet been effected. As always happens in these cases, the fault was attributed to the engineer as though he had not taken all precautions to ensure the success of the work...... The contractor has committed blunder after blunder...... and had I waited a little longer before coming Saldae would have possessed two tunnels instead of one". The two sections were joined by a transverse tunnel and Saldae obtained its water supply with great rejoicings.

The sedimentation of water and the application of salts to promote the settling of particles of mud were practised even before the days of the Romans.

Municipal engineering passed through a long period of decadence after the fall of the Roman Empire and the gross insanitation of the Middle Ages was the cause of the terrible list of pestilential diseases from which the people suffered. London (England) depended upon wells and the Thames for its supply of water in the Middle Ages. Water wheels and horse engine pumps were installed. Hugh Myddleton in 1613 constructed the New River scheme, the first of its kind in Britain. It was in London that Simpson in 1829 built his first slow sand filters although it is evident from the records that these were not the first of their kind. Liverpool started its waterworks in 1799, by sinking wells 73 to 600 feet deep into sandstone beds. This city now derives its supply from the Vyrnwy works in Wales. Manchester was in sore straits for water for we are told that in 1578 the authorities ordered its officials that "no person shall take water from the conduit in any vessel of greater capacity than one woman is able to bear filled with water, and but one to every house at one time, and to take their turn as hath been accustomed". This meant about five or six gallons per day per house. Permanent waterworks were started in 1813, when stone pipes were laid with Roman cement joints, just as the Roman had done 1800 years before. Manchester now draws on Lake Thirlmere for its supply. Edinburgh laid lead pipes in 1681 from Comiston to a reservoir on Heriot's Ridge. These were found to be inadequate and iron pipes were laid in 1787. Glasgow provided waterworks in 1809. It was here that James Watt devised 15-inch flexible iron pipes to be laid across the river in 1810. The design and method of laying was very similar to our present day practice. A 28 inch and another 36 inch flexible iron pipes were subsequently laid. (The Loch Katrine water works for Glasgow require no description as they are doubtless well known to all.) The development of waterworks in Britain during the last century are familiar to all, the average consumption of water for all purposes is about 35 gallons per head daily.

Boston (Mass.) in 1652 was the first city on this continent to have water works. Steam pumps were used at Bethlehem (U.S.) in 1754.

Let us now study the waterworks section of municipal engineering in Canada. So far as the writer can ascertain St. John (N.B.) was the first to have waterworks. This was in 1837, followed by Toronto, 1841, Halifax (N.S.), 1848, Kingston 1850, Montreal and Quebec 1857, Hamilton 1860, Windsor and Sorel 1872, Ottawa 1874, Victoria 1875, Sarnia and Three Rivers 1876, London 1878, St. Catharines, Guelph and Moncton 1879, Owen Sound and Sherbrooke 1880, Peterborough and Brockville 1882, Stratford 1883, Niagara Falls and Nanaimo 1884, Hull 1885 and the majority of the remainder of the 530 water works were built during the life of *The Engineering Institute*.

According to the report of R. H. Coats, the Dominion Statistician for 1919 there are about 4,500 miles of water mains in 53 Canadian cities of 10,000 population and over. It may be interesting to give the mileage of water mains per 1,000 population. The following were calculated at random, as the writer had not time to analyse the complete list.

	per 1,000 population water mains		per 1,000 population water mains
Medicine Hat	3.2 miles	St. Hyacinthe	1.90 miles
Woodstock	3.00	Regina	1.88
Moose Jaw	2.90	Ottawa	1.76
Calgary	2.76	Hamilton	1.75
Niagara Falls	2.66	Kingston	1.63
Edmonton	2.50	Charlottetown	1.57
New Glasgow	2.50	Winnipeg	1.45
London	2.30	Saskatoon	1.40
Vancouver	2.15	Toronto	1.18
Sherbrooke	2.10	Montreal	0.65

The same report gives a list of towns where the water is wholly or partly metered. The following is representative.

	percentage metered	daily consumption gallons per head
Verdun	100	79
Moose Jaw	100	41
Edmonton	95	65
Kitchener	93	68
Winnipeg	91	50
St. Boniface	90	33
Regina	82	46
Stratford	75	44
Brandon	67	73
Brantford	64	81
St. Thomas	50	108
Victoria	41	110
London	36	85
St. Catharines	37	175
Toronto	34	125
Lethbridge	30	125
Port Arthur	25	134
Calgary	24	148
St. John (N.B.)	20	290
Sarnia	6.6	292

The daily consumption in gallons per head is given below, they are based on the Dominion Statistics for 1919

Sarnia	292	Galt	122
St. John (N.B.)	290	Woodstock	120
Lachine	260	Amherst	112
Hull	250	Victoria	110
Medicine Hat	224	Three Rivers	108
Moncton	204	St. Thomas	108
Niagara Falls	200	Charlottetown	100
Halifax	200	New Glasgow	100
Sault Ste. Marie	193	Quebec	100
Levis	191	New Westminster	90
Ottawa	191	London	85
Windsor	190	Brantford	81
St. Catharines	175	Owen Sound	80
Vancouver	155	Verdun	79
Calgary	148	Brandon	73
Peterboro	146	Kitchener	68
Sherbrooke	145	Edmonton	65
Montreal	140	Saskatoon	64
Fort William	138	Winnipeg	50
Hamilton	136	Regina	46
Port Arthur	134	Stratford	44
Belleville	133	Moose Jaw	41
Lethbridge	125	St. Boniface	33
Toronto	125	Kingston	17
Sydney	122		

The information given with reference to the filtration and chlorination of water is not quite suited for the purpose of analysis and the subject will therefore not be pursued further.

Sewerage

Metcalf and Eddy quote Carl Merckel to the effect that the first record of a sewer is from old Babylon. Arched sewers were found in Niniveh, dating from the seventh century before the Christian era. Jerusalem and Athens had sewers. Frontinus stated that a portion of the supply of water was necessary to cleanse the city and to flush the sewers of Rome.

Sewers built on a systematic plan were laid in Hamburg in 1843. The first study of the sewerage system in London was in 1847 when sanitation was exceedingly unsatisfactory, but nothing was done until 1859. Owing to the great distress caused in Lancashire by the failure of the supply of raw cotton from the United States during the Civil War in 1862 the British Government organized relief works and the construction of sewers in Lancashire towns was carried out.

The report of the Dominion Statistician contains information respecting the mileage of sewers and the following result of analyses were made at random.

	Sewers miles per 1,000 population		Sewers miles per 1,000 population
Medicine Hat	3.2	New Glasgow	1.45
Calgary	2.76	Ottawa	1.37
Port Arthur	2.66	Hamilton	1.30
Victoria	2.58	Winnipeg	1.27
Edmonton	2.30	Sherbrooke	1.15
Moose Jaw	1.95	Toronto	1.13
Amherst (N.S.)	1.82	Belleville	1.12
Regina	1.75	Halifax	0.83
London	1.73	Montreal	0.82
Vancouver	1.60	St. John (N.B.)	0.77
		Hull	0.53

There were about 4,000 miles of sewers in 1919. The method of designing sewers has become more rational during the last few years, although some factors have yet to be more fully understood, before we can consider the science to be satisfactorily established.

Sewage Treatment

With regard to Sewage Treatment the sewage from Ancient Athens was apparently used for irrigating land. Bunslau (Germany) about 300 years ago and Edinburgh about 100 years ago disposed of the sewage on land. Towns and cities in Britain probably have tried at least as many methods of sewage treatment as those in any other country. The rivers and streams are small and with a dense population, great industrial works and the rapid and general construction of sewers, these streams become grossly polluted. Legislation was passed for the purpose of remedying these conditions and the municipalities were compelled to adopt measures to prevent the pollution of streams. Land irrigation, at first, was the general method of disposal of sewage, but as soils of different kinds were not equally suitable many of the sewage farms became sick and the conditions of some streams were little better than before. Then Bailey-Denton's intermittent downward filtration schemes were tried. Some years ago, the writer had the opportunity of studying sewage treatment problems in general, and visited every known process then in use in Britain. These included about 70 different works, comprising, broad land irrigation, intermittent downward filtration and land, settling tanks and land, chemical precipitation and land, chemical clarification and filters, electrical treatment and biological treatment. The municipalities had spent enormous sums in trying various processes and there were advocates for every one of them. Birch's at Birstal, Bacillite at Lifford, Oxygen Process at Dublin, Amines near Chester, Coke beds at Barking, Lowcock's aerated filter, Scott-Moncrieff's cultivation filter beds, Garfield's Coal beds, Magnetite and Polorite filters, Septic tanks at Exeter, Cosham tanks at Nuneaton, Dortmund tanks at Loughborough, Hydrolytic tanks at Hampton and several others, the result of which contributed to our store of information.

Experience of a similar kind has been gained in Canada and the United States, although the problem to be solved is not so acute as in Britain. The following paragraph is quoted from an address delivered by the writer in February 1920. "Mr. Willis Chipman, M.E.I.C., in 1912 read an interesting paper at the Annual Meeting of the Canadian Public Health Association giving the history of several sewage works. The first practical attempt at sewage purification in Ontario was on the flat bed-irrigation system at the London Asylum in 1888. The first municipal sewage works built in this country was at Kitchener in 1892 followed by Waterloo in 1894. Hamilton installed the first chemical precipitation plant with presses in 1896. Stratford and Kitchener were the first to have septic tanks and Vernon (B.C.) in 1912, the first trickling filters. The Activated Sludge process was developed in Manchester in 1913. The Massachusetts State Board of Health has been conducting experiments in sewage treatment since 1888 and the Activated Sludge process was founded upon investigation which had been made at St. Lawrence Station." During recent years the two-storied tanks with trickling filters have been extensively used in North America. The experience points out that the combination is not uniformly successful. Now we have the Activated Sludge process. This has been already tried on a more or less extensive scale at Manchester, Worcester, and other towns in Britain, also in Milwaukee, Chicago, Urbana and Baltimore in the States, and while it cannot be said that the millenium has arrived, this process has been found to produce a satisfactory effluent, though the sludge problem still remains to be solved. The method by which aeration and agitation can be effected is considered by some to be capable of improvement. The original method is by the direct use of compressed air and porous tiles. Haworth, at Sheffield, uses mechanical propellors which induce a sufficient supply of air. The Dorr-Peck System relies upon revolving screens, trays and sludge thickeners of special design with compressed air. The Trent Engineering Co. return the sewage by pumping and air is drawn with the flow of sewage. Cooper of Wimbledon suggested atomizing the sewage and others propose aeration by spraying. The disposal of the sludge is proposed to be effected at Milwaukee by pressing the same into cakes, or by centrifuging machines. Toronto, is experimenting on the digestion of the sludge. The revolving screens in the Dorr-Peck system when tried at Mount Vernon, N.Y., removed over 12 per cent of the suspended solids and the sludge contained 98.5 per cent water. This system is being tried at Urbana and Argo, Ill., and we look forward to the report which will be published in due time. The Activated Sludge process is in operation at Brampton, Agricultural College Guelph, and will shortly be in use at Guelph and Woodstock.

Streets and Roads

The Romans built roads on a huge scale radiating from Rome to all parts. They were primarily military roads for the purpose of more effectually keeping in communication with the distant conquered territories. These roads afterwards became the principal highways. Roman streets were laid out and had practically the same camber and similar sidewalks as we now construct. The ancient Egyptians laid out, about 5,000 years ago the town of Kahun, very much on the same lines as our towns excepting that the streets were much wider. Prof. Flinders Petrie states that Kahun was built "to accommodate the workmen and others engaged in the building of the pyramid of Illahun" — this is probably the first great housing scheme. Town planning is therefore an ancient art.

The roads in Britain in former days, were allowed to fall into disrepair, but a century ago, a great change took place and today the roads are equal to any found elsewhere. Canadian streets and roads have passed, and are passing, through a similar course of development, and the movement for good roads has now been firmly established. The following statistics have been calculated on the basis of the Dominion Statistician's report for 1919. They have been selected at random as time does not permit reference to all of the cities.

	Street Mileage per 1,000 population		
	Improved	Unimproved	Total
Medicine Hat	2.45	19.00	21.45
Port Arthur..	5.00	6.90	11.90
Edmonton.....	2.42	8.18	10.60
Winnipeg......	0.89	1.53	2.42
Regina.........	0.77	1.90	2.67
Hamilton......	1.17	0.39	1.56
Ottawa........	1.05	0.44	1.49
Montreal......	0.51	0.65	1.16
Toronto.......	0.77	0.30	1.07

The improved streets include macadam, asphalt, tar-macadam, wood and others and these measure altogether about 3,000 miles. The mileage of unimproved roads is about 4,000.

Other Works

A canal was built almost on the line of the present Suez Canal about 630 B.C. by Necho and Darius. The Persians, Romans and others also built canals, large syphons, and irrigation works. The Roman baths were of enormous size. One of them could accommodate 3,600 bathers at one time. Public Baths are, in Canada, institutions which will come in due time.

Building construction was a noble art 40 centuries ago, and the public institutions erected by the ancients constitute the classical examples for the modern world. The ruins of the palace of Chosroes at Ctesiphon near Babylon built 550 A.D. of mud brick and standing today has a vaulted roof which, according to William Warfield has a span of about 86 feet and a height of about 95 feet.

Canada, like the United States, is, relatively, a new country. One hundred years ago, only three per cent of the population in the United States dwelt in cities of 30,000 population, or over, whereas 33 per cent does so now. According to the Ontario Municipal Statistics for 1919 about 41 per cent of the population live in 23 cities. The growth of cities and towns, in this country during the last generation has been remarkable. Several of them were either not on the map or were an aggregation of shacks 35 years ago, but now stand prominently on the list in respect to municipal engineering works which they have undertaken. One half of the cities in Canada have become incorporated as such since the year 1900.

The name of Frontinus has been mentioned in this paper and in concluding it may be interesting to make one further reference to him. He was appointed by Emperor Nerva to the permanent office which was equivalent to that of Water Commissioner of Rome, succeeding others who had held that office during the previous 100 years. This office, however, had been in existence for 270 years before the Christian era, though it was not then permanent. Its importance may be estimated by the fact that when the Water Commissioner went on duty, outside the city he had two lictors to lead the way also three public servants, an architect (otherwise an engineer), and a number of writers, clerks, assistants and criers. When the Commissioner went about the city on duty he had the same attendants, minus the lictors. The Commissioner also attended to the superintendence of streets and to the distribution of grain. We have, therefore, to abandon the idea that the office of City Commissioner is a modern one.

The moral it is desired to point in this connection is that municipal engineers are entitled to fuller consideration by the public. Their function is to carry out and maintain works which have for their object the conservation of public health, the provision of facilities for easy transportation, and the enhancing of the amenities of the people. Municipal engineers enjoy the advantages of the great developments of science which have taken place, especially during the last century, and the phenomenal results of researches in chemistry and bacteriology in relation to sanitation are revealing more fully the wonderful forces of Nature that are at their disposal.

The Activated Sludge Process of Sewage Disposal*

A description of the process, with a discussion of advantages, disadvantages, present tendencies in the sludge problem and the question of by-products.

George G. Nasmith C.M.G.

Advance Proof of Paper to be Presented at the General Professional Meeting, Toronto, February 2nd, 1921

In discussing any system of sewage disposal it is necessary to know exactly what that system is capable of doing under the very best of conditions and, what is of even more importance, to be sure of what it is likely to accomplish under average conditions. We need to know, in fact, not only the best but the worst features of any system.

An ideal system of sewage disposal should turn out a clear and stable effluent and an easily dewatered, inoffensive sludge; it should accomplish these results without causing offense during the operation and at the minimum cost. In practice a sewage disposal scheme is usually, unfortunately, a compromise between the results desired and the money available for building the plant.

At present there are three inoffensive methods of sewage disposal that are capable, when carefully operated, of yielding a clear, stable effluent and a non-putrescible sludge. These are combinations of:

1. Sedimentation tanks, sludge digestion and trickling filters;
2. Imhoff or Travis tanks and trickling filters;
3. Activated sludge process and sludge digestion, (or drying the activated sludge by centrifugal action, sludge presses and other means.)

The two first combinations are well-known and though the inoffensive digestion of sludge in separate single chambered tanks presents some difficulties, it can be, and is being done on a very large scale as at Birmingham and Baltimore.

The Activated Sludge Process

The activated sludge process now being developed is the subject of this brief review. Activated sludge, prepared by long continued agitation of sludge with air, is a brown, flocculent, gelatinous material largely composed of living bacteria possessing certain definite characteristics, and is capable of bringing about profound modifications in fresh sewage when agitated with it in the presence of air for a considerable length of time. After such treatment the settled sewage effluent is clear and practically all of the suspended and dissolved organic matter has been entrapped or converted into inorganic matter by the activated sludge. At the same time most of the bacteria have been removed from the sewage while the effluent has been rendered non-putrescible and comparatively innocuous.[1]

The activated sludge process is in itself relatively simple. The apparatus consists of tanks containing a quantity of activated sludge previously prepared, means for introducing air at the bottom of the tanks for aerating and agitating the mixture of activated sludge and incoming sewage, and other tanks or compartments for allowing the activated sludge to separate from the liquids. Mechanical means for agitating the mixture of activated sludge and sewage in presence of air will yield exactly the same results as agitation by means of compressed air, and experimental work now being carried on indicates the probability of such methods coming to the front in the near future.

The activated sludge process will, when the simple but essential conditions of operation are carefully observed, yield a clear, sanitary, non-putrescible effluent. The excess of activated sludge produced is, however, still putrescible, can at present not be cheaply or easily dewatered, and is difficult to dispose of. Should the dewatering problem be economically solved the activated sludge process of sewage disposal would immediately become more desirable and feasible than it is at present, chiefly for the reason that activated sludge has a high fertilizing value and is therefore, valuable from the standpoint of conservation. The activated sludge process as carried out at present, though embodying many good features, has some undesirable ones, and is by no means the last word in sewage disposal.

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Advantages of the Activated Sludge Process

The advantages of the activated sludge process of sewage disposal are, first,—that the plant is comparatively simple in construction, consisting, as it does, of a series of tanks and means for injecting finely divided air at the bottom of the same. Second,—that it will produce in the one operation an effluent that can be obtained in other systems only by a combination of operations. Third,—that it is, during operation quite inoffensive, and fourth,—that it can be carried on with the minimum amount of pumping.

Viewed from the standpoint of inoffensiveness, simplicity of operation and stable effluent, a combination of two-storey tanks and trickling filters may be quite as satisfactory as the activated sludge process. In fact, such a combination may be highly desirable where plenty of fall would make the operation almost automatic, where expert assistance is unobtainable or where economic considerations would make the activated system undesirable or even impossible.[1]

Disadvantages of the Activated Sludge Process

The inherent disadvantages of the activated sludge process over other combinations are not negligible.[2] Where improperly operated, the effluent is neither stable nor sanitary. Disinfectants and certain trade wastes are liable to destroy the activated sludge; under these circumstances it will take weeks to build up again the necessary volume of activated sludge. The filtros plates used for finely dividing the injected air are subject to plugging with smoke and dust,[3] in which case the areas of sludge not agitated are apt to undergo anaerobic decomposition, while there are inherent difficulties with air blowers and other mechanical features of the aeration system. Though attempts have been made to derive an income from the dried activated sludge as a fertilizer, the hopes entertained have not as yet been realized in practice and it is doubtful if the day has yet arrived when the chemist or sanitary engineer is honestly justified in advising that an activated sludge system be constructed with the guarantee that the increased cost of the plant or the high cost of operation will be compensated for by the sale of sludge or other material derived from the process.

On the other hand, some cheap method of satisfactorily dewatering the sludge may entirely change our viewpoint in regard to this matter. The activated sludge system is unsuitable for small communities or large institutions where an automatic system is highly desirable.[4] and [5]

Present Tendencies in Regard to the Sludge Problem

With one group of investigators the object is to eliminate at the beginning of any process of sewage disposal as much of the organic sewage matter as possible in the form of sludge, and to leave an effluent which is finished or can be finished at a high rate of speed or is good enough to be disposed of after disinfection or without further treatment.[6] Such objectives are included in chemical precipitation processes and the activated sludge process, both of which necessitate the further disposal of enhanced quantities of sludge. For example, treatment with sulphurous acid at Lawrence gives an increase of 32% in the dried sludge over that obtained by plain sedimentation.[7]

With another group of investigators, the object is actually to convert into stable compounds and gases, through the destructive biological action of bacteria and other forms of life, as much as possible of the organic matter present in the sewage, leaving for final treatment the smallest possible quantity of stable sludge.

It is possible that both of these objectives may ultimately be included in the same system with entirely satisfactory results.

The questions of greatest interest to us at the present time are,—a: whether this dewatering problem is soon likely to be solved, and—b: whether the problem of digesting sludge without offence and cheaply will revolutionize other methods and, if so, which will then be the more desirable process. At the present time we are unable to answer these questions. Huge works as at Birmingham[8] and Baltimore[9] have been constructed where a combination of plain sedimentation tanks, double-storey tanks, sludge digestion tanks and trickling filters are operating on a gigantic scale. On the other hand, activated sludge systems with a capacity of fifteen million gallons a day appear to be working satisfactorily in Houston, Texas;[10] while Milwaukee has committed itself to a municipal plant counting, it may be said, on a revenue from the sale of the dried activated sludge for fertilizing purposes to reduce the otherwise high cost of operation.

The De-Watering of Sludge

The dewatering of sludge can only be brought about in two ways, viz.: the expression of the bulk of the water present by pressure methods such as the sludge press—a very cumbersome and objectionable process—or through the more recent method of centrifugal action. Both of these methods will produce a sludge cake containing from 75% to 80% moisture from which the remaining moisture must be removed by heat.

A centrifuge of the Basco Ter Meer type has been experimented with for a month at Milwaukee and promises to be more suitable for dewatering Milwaukee activated sludge than sludge presses. The machine is almost automatic in operation, occupies 15 minutes for each cycle, and will centrifuge from 2,000 to 4,000 U. S. gallons of sludge per hour. It takes a sludge containing 98½% moisture and reduces the moisture to from 79% to 85%. About 20% of the solids of the sludge pass over in the filtrate and it is expected that, with experience and improvements, it will prove more efficient and satisfactory than any type of sludge press hitherto tried out.

By-Products from Sludge

Some have built their hopes upon methods designed to obtain some valuable by-product from sewage sludge—particularly fats, which are present in considerable quantities. Others have pinned their faith to methods for dewatering and drying sludge with the idea that the dried product will prove saleable as a fertilizer. A few believe that the B.T.U.'s in dried sludge, (4,000 to 5,000), will make it valuable as an ingredient to incorporate with coal dust in briquettes for fuel purposes. This last proposition is so absurd from the economic standpoint that it is merely referred to.

The Grease and Oils in Sewage

Grease may be obtained from sewage in two ways: a—by mechanical means of separation which are not very efficient and b—by chemical means, which involves the employment of expensive chemicals to acidify the sludge. One such method, the Miles Acid Process, depends on the fact that sulphurous acid gas, a comparatively cheap material, when added to sewage, breaks up the soaps and frees the fatty acids which become entrapped with the colloids and solids of the sludge and are separated with them. When such acid sludges are dried copious fumes of sulphur dioxide and acrolein vapors are given off and the grease obtained by abstraction and distillation gives extraordinary amounts of tar and unsaponifiable matter.[11]

Even when treated by the Cobwell Process in which degreasing takes place simultaneously with dehydration, the results are grease and fatty acids, which have no marketable value at the present time, and a low grade 3% ammoniate. A town of 150,000 people would yield five tons of tankage and one ton of grease daily, but as the grease has value only when it has been refined and made into marketable products, it may readily be seen that no income can be expected from such a process and from that viewpoint the process may be dismissed from our discussion.

The sludge obtained at the Baltimore sewage disposal works in 1915 with sulphuric acid treatment had a very objectionable odour and dried on sand beds much less readily than good non acidified sludge; no manufacturer would even consider the proposition of taking the fat which might be obtained from the Baltimore sewage works.

From this it may be seen that the acid process at present holds out few inducements or hopes of successfully solving any of the main difficulties of sewage disposal, though it may have a place in the disposal of trade wastes.

The Fertilizer Value of Sewage Sludge

Numerous experiments have shown that the dried sludge from sewage disposal works is a valuable fertilizer. Of the various kinds of sludge the activated sludge has a higher nitrogen and phosphoric acid content, is more readily available for plant growth and is therefore, the most valuable as a fertilizer as Bartow, [12] Nasmith and Mackay [13] and others have shown by many comparative tests with vegetables.

Imhoff sludge is also valuable as a fertilizer and is used with great success in growing vegetables in the vicinity of the main Toronto Sewage disposal works. In Baltimore 25¢ a load is paid for the dried Imhoff sludge produced at the works.

At Milwaukee it is expected that the dried activated sludge will be sold as a fertilizer base, the price being based on the nitrogen content.

Improvements in dewatering sludge by centrifugal action or other means, or improvements in methods of digesting sludge may entirely change our present attitude with regard to sewage disposal and make one or other system the much more desirable.

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Some Controversal Points in Concrete Specifications*

A discussion on the difficulties in preparing concrete specifications, with particular reference to the provision of greater detail in clauses dealing with workmanship

Frank Barber, A.M.E.I.C.

Advance Proof of Paper to be Presented at the General Professional Meeting, Toronto, February 2nd, 1921.

"Make for thyself a definition or description of the thing which is presented to thee, so as to see distinctly what kind of a thing it is, in its substance, in its nudity, in its complete entirety, and tell thyself its proper name, and the names of the things of which it has been compounded, and into which it will be resolved. For nothing is so productive of elevation of mind as to be able to examine methodically and truly every object which is presented to thee in life, and always to look at things so as to see at the same time what kind of universe this is, and what kind of use everything performs in it, and what value everything has with reference to the whole"
— *Marcus Aurelius Antoninus.*

It is true that concrete has been used since the times of ancient Rome, nevertheless the history of modern concrete construction covers only a very short period. Therefore it is not to be expected that engineering should have become crystallized into standard practice upon concrete structures as it has upon those of steel which was already in possession of the structural field when concrete was reborn scarcely more than three decades ago.

Steel Specification Practice

In steel, practice in design and in construction are equally uniform, and doubtless this has been brought about very largely by the use by engineers of good standard specifications. This fact, however, stands out prominently, in concrete, practice in designing is much more uniform than in workmanship. Has the use of standard specifications helped to unify designing in concrete as it has in steel, and if so why has not their use led to standardizing workmanship as well as designing? It may be worth while to examine into the causes for this difference in uniformity between concrete design and construction.

The mining engineer is dealing always with hazards, and this doubtless trains the speculative side of his mind and perhaps tends to keep him open-minded. But the lawyer has his precedents and the civil engineer his factors of safety, and heaven forfend that the writer should belittle the necessity for either of them. The focussing of the attention upon these, however, in the course of years must deepen and intensify the engineer's natural conservatism; (a considerable amount of which is required by all solid citizens), until this may perhaps become a prevailing habit in thought. We civil engineers, no less than lawyers and preachers are to a considerable extent stand-patters. It was thus, perhaps, inevitable that concrete specifications should have been largely moulded upon the better known specifications for steel which had stood the test of time. Now steel specifications as adopted by engineers and embodied in agreements with contractors all include adequately detailed directions not only for fabrication and erection, but also for designing. The necessity for including the latter becomes evident when we consider that the universal practice on this side of the sea is that the contracting steel company prepares the detailed designs, and the consulting engineer prepares merely the stress and the material sheets.

Concrete Specification Practice

In concrete, on the contrary, the no less universal practice is that the engineer prepares completely detailed designs of his structure. There is consequently no good reason for including directions as to designing in the agreement with the contractor on concrete structures, it being a matter of indifference to him what specifications the designer used. (Here some Scot will remark that the contractor may wish to know how the structure is designed, as he would not wish to have his name associated with a possibly unsafe structure; and the answer is that if the contractor has reason to fear for the sufficiency of the designs, he should have his own engineer check the designs themselves according to the rules he considers sufficient, not merely read the specifications according to which it is said to be designed.)

We must arrive at this conclusion, if our premises are admitted, that those clauses of a concrete specification governing materials and construction are addressed to the builder or contractor, but those concerning designing are solely for the engineer. Consequently, there may be and should be a great difference in character in the two kinds of clauses, although the writers of concrete specifications have as yet not taken this into any account. The clauses for the engineer may be merely advisory, those governing the contractor must be mandatory.

Those most competent to write down the laws which should govern designing are the laboratory engineers who have made tests and reported upon them, those who have examined these at first hand and correlated the results, the writers who have wrought these results into text books, and the professors who teach from the same. Those best able to prepare specifications to be embodied in the contract are the busy engineers who have spent more of their time supervising structures, who have dealt most largely with contractors. It is to be noted, however, that the former are also authorities upon materials, the specifications for which are also to be part of the contract. The first class are by far the better and more prolific writers, and it must be admitted that in most of the general concrete specifications containing both kinds of clauses those upon materials and design far exceed those upon workmanship both in excellence and also in number and length. This proportion is indefinitely perpetuated, for specification writing is often and largely a matter of work with the scissors, and naturally the more numerous clauses of existing specifications have the best chance of survival as a class.

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The Importance of Specifications Dealing with Workmanship

It is easy to see the effect of this on present practice. Concrete designing has been specified in elaborate detail in standard specifications for some years, and consequently designing has become standardized to a gratifying extent. Workmanship has not been adequately treated in standard specifications, and workmanship in concrete structures varies all the way from excellent to bad and worse.

It is difficult for a constructing engineer to lay his hands upon any specification recognized as standard which is not top-heavy with clauses on designing, which are useless for his purpose, and a further aggravation is that these are often scattered amongst the clauses upon materials and workmanship. But even if they are not so mixed up, the functions of the two kinds of clauses are nearly always confused. For instance in the E.I.C. specifications which will be referred to more particularly later, the words "if practicable" occur no less than four times in the clauses under workmanship. These words would be satisfactory in clauses upon designing for the instruction of the engineer, but are used unfortunately here.

Analysis of Some Features of the E.I.C. Specifications

This short analysis would be incomplete without a more detailed examination of typical clauses. For this purpose the writer has chosen the clauses under one heading only, "forms", taking these as typical of the others, and has subjoined all the clauses under this which are contained in the "Standard General Specifications for Concrete and Reinforced Concrete" recommended by a general committee of the E.I.C. and submitted for approval to the annual meeting in 1915. These specifications were chosen for comment because it seems more fitting to use something of our own for criticism, than those of some particular engineer or city. It is not because the writer believes them to be less excellent than other standard specifications. They are indeed not very different from most others. A set of suggested clauses upon the same subject are also subjoined; these are submitted with great diffidence and after considerable hesitation, not as models, but to show that there are omissions in the standard which must be supplied before practice in workmanship can become uniform through their aid. Do not suppose that the writer is more satisfied with them than the severest of critics can be. But there is no wish to be merely a destructive critic, this method is best adapted to show the omissions referred to, and however inadequate they may prove to be the writer ventures to hope for forgiveness if it is remembered that first attempts at constructive criticism are nearly always shown to be unsatisfactory in the light of later knowledge. Furthermore criticism of this proposal for filling the voids, so far as it is criticism of the details of it, will be largely aside from the point. The question is, are there voids, not whether they have been properly filled.

Concrete construction is largely a carpenter's job. A concrete truss bridge superstructure, for instance, of say 80 ft. span will take weeks of the carpenter gang's time on the forms, and the concreting will be accomplished in as many days. The same is largely true of open spandril arches. Yet the E.I.C. specifications have only four clauses on forms, two of them, 54 and 64 (widely separated) referring to form removal and clause 60 to form cleaning. Only one clause, albeit a lengthy one, refers to the building of forms. The centering for a 200 ft. arch will perhaps take 200,000 ft. B.M. of timber, and this constitutes a more important work in itself than a large mill building. Can we specify the construction of a mill building in one clause? The Pont Sidi Rached in Algeria was designed by no mean engineer, but for the centering of the main arch recourse was had to Séjourné, probably the greatest arch engineer in Europe, as the design of the centering was considered more important than the design of the bridge itself. Now according to the universal practice on this continent, the forms are designed by the contractor (under the specifications) and merely checked by the engineer, and there is the same reason for including specifications for design for centering and forms in concrete building specifications as for including specifications for design of the structure itself in steel specifications. The writers of the E.I.C. specifications of course know this, otherwise they would not have included clause 47 on form design; yet we shall look in vain for any enlightenment upon unit stresses allowable in various kinds of timber, upon the kind and character of timber allowable for various uses, upon timber foundation piles, upon the preparation and approval of plans of the forms, upon assumptions regarding settlement, upon assumptions regarding dead, live and wind loads.

Some may consider that the examples given above are extreme and should be treated in special specifications; they may say that the Sidi Rached bridge was not intended to be covered by the E.I.C. specifications. Indeed there is reason to believe that neither large nor any kind of arches were in mind by the Committee when many parts of their specifications were in preparation. Arch centering, for instance, was plainly not in mind when Clause 64 (given below) was written. But these were undoubtedly unintentional slips and not worth attention except as such. A large arch was mentioned on account of the importance of its centering, but large arches are fairly common and are becoming more so. Some may also be sceptical as to the value of another example mentioned above, that of concrete trusses, supposing them to be rare curiosities. For instance in an article on "Concrete Bridges" in the Canadian Engineer in 1918 the writer says "Concrete trusses are so rare they need hardly be discussed". Such engineers are not entitled to assume the dignity of sceptics, they are merely unfamiliar with facts. In 1918 nearly one-third of all Canadian concrete bridges over 60 ft. in span were concrete trusses. Even if it were true (and it is not) that trusses and large arches are rare, what is the conclusion? That specifications for forms are not important? It is true that the centering for any panel of a large building is less important than that for a great arch, but by the multiplicity of the panels in the building the forms become equally important. In a small building or bridge the forms are of course less important, but so are the other factors. In most concrete structures the forms are important in comparison with the whole work, and are as much entitled to consideration as the other elements of construction. The writer cannot believe, however, that the Committee did not intend the E.I.C. specifications to apply to all concrete structures. There are many indications that they did. For instance several clauses are included to deal with the difference of treatment between cinder concrete and stone concrete and surely the specifications of this great body, the E.I.C. or any other "standard" specification should deal with bridges as well as buildings, with large bridges as well as small, with arch and truss bridges as well as those of beam and slab construction.

The Question of Detail

It may be said by some engineer that detailed specifications for forms, or for construction generally is not required, since it may better be left to the engineer's approval. The answer to this is that all the clauses under the head of materials could be omitted for the same reason, also the clauses under any other head; why have a specification at all, just leave it to the engineer's approval? This indeed is a swift solution, not only for this but for many other questions, and considerable use is sometimes made of it by engineers who do not know themselves what they are ready to approve and who do not wish to be forced by writing a detailed specification to decide between the various possibilities. But since this reason for leaving out clauses applies to one part of a general specification as much as to another the settlement of the question it raises is somewhat beyond the scope of this enquiry. The present question is not, are adequately detailed specifications required at all, but, admitting that they are required or advisable for design and materials, are they not equally desirable for construction?

The writer believes that the principal objection against specifications for concrete workmanship which will be raised from time to time until adequately detailed specifications for construction become a part of all standard specifications and contracts, is that it would make the specifications too bulky. Such objectors if shown any one clause (as for example that giving unit stresses allowable for timber centering) would doubtless admit the desirability for its adoption. Even several clauses chosen at random would probably receive equal welcome, but if we say that these are merely typical of clauses required to fill gaping voids in various places, he will perhaps slam the door upon them all and retire to his voids. The specifications he will say will become too long. One is prepared to accept this objection as conclusive when such objectors can answer some questions such as the following: How long should a specification be for any certain work? When this length is attained, what paramount consideration then obliges us to leave out clauses which would otherwise be considered necessary? And why should those clauses on construction be cast out rather than clauses in other parts of the specifications? Why not cut out clauses chosen at random, so many to the page? It is suggested that it may be worth while first to draught adequate construction specifications and then count the pages before condemning it for being too long.

Suggested Clauses in Concrete Specifications

The suggested clauses on forms given below are from the writer's "General Specifications for Building Concrete Bridges" as used for many years (except for yearly amendments) and the construction clauses are fairly full if not complete. They contain thirteen pages of the same size as those of the E.I.C. specifications on materials and workmanship and six pages on general clauses, or nineteen pages in all. The E.I.C. specifications contain eleven pages under the first head and seven and one-half pages of general clauses, or nineteen and one-half pages in all, not of course counting the E.I.C. clauses on design, of which there are eleven pages further. The two specifications are thus about the same length, but those of the writer are on bridges only. By a comparison with other specifications covering all structures about three extra pages only would be required to allow them to include all concrete structures because bridges include nearly every kind of structure already. When the bug-bear of "length" is faced in his lair he will be found to be not a big grizzly but only a little brown cub.

Only the clauses dealing with forms have been chosen for detailed analysis, principally because these are believed to be generally least satisfactorily treated, but in order to show that the question raised concerns other parts of specifications on construction there are also subjoined all the clauses or parts of clauses in the E.I.C. specifications referring to concrete joints, that is the juncture between fresh concrete and concrete which has set, and also tentatively suggested clauses covering the same. No comment is given upon this sub-heading as it is of course understood that the purpose is not criticism of details, and the criticism of the clauses on forms is only incidental to the main question.

Every specification which is to be called "standard" makes a bid for general adoption, and it must be fairly widely adopted if it is to accomplish its main purpose of solidifying practice to good standards. But the E.I.C. specifications have not to the writer's knowledge been generally adopted, even by those approving of them when they were discussed in draught form.

We are in a rut and shall perhaps not attain to any more complete success until we are able to climb out of it. This is always difficult, and here we are doubly unfortunate because ruts connected with anything labelled "standard" are deeper than the foundations of hades. We must first admit and see clearly that we are in the rut or we shall never even look for a ladder. We should be cheered by the fact that concrete specifications writers have largely succeeded in one division already, that of designing. Probably the recommendations prepared by what is known as the "Joint Committee" have had the greatest effect in this. What is required is a specification which will do as much for construction. It is suggested as one rung of the ladder which must lift us out of the ditch that the E.I.C. specifications covering materials and construction should be amplified and printed together with the general clauses, the specifications on designing to be published separately. There would be at least a good chance of engineers adopting them as part of a contract. If this were accomplished the specification would soon earn its title of "Standard".

SCHEDULE "A".

E.I.C. report of the General Committee on
Standard General Specifications for Concrete
and Reinforced Concrete.

1. Clauses on Forms.

Form Work.

Clause 47. Form work shall be substantially and accurately constructed. It shall be plumb and true to line, well fixed, braced and supported to carry the imposed loads, and be rigid enough to retain proper alignment and correct contours until the concrete will have become well set. Form work shall be sufficiently tight to prevent leakage. Immediately before depositing concrete the forms shall be carefully cleaned out, after having been finally trued up. A thin, even coating of soft soap or oil may be applied to new forms before erection. Such a coating shall be applied in every instance where form work is to be used more than once. Form work that has been previously used shall be thoroughly cleaned before re-erection and given a protecting coat of the same material as that already used in it. Form work shall be so fastened together that it may be removed without injury to any part of the permanent structure.

Form Removal.

Clause 54. The forms shall not be removed from concrete work until the concrete is safely self-supporting, and where additional concrete is to be added, until it has sufficient strength to safely sustain the superimposed load.

Cleaning of Form Work.

Clause 60. Immediately before depositing the concrete the form work shall be entirely cleaned of all foreign material, preferably by the use of a pressure hose and nozzle discharging water, steam or air.

Form Removal.

Clause 64. The forms shall not be removed until the times named in the following table have elapsed after depositing concrete, not counting periods in which the temperature has been below 35 deg. Fahrenheit.

Part	Minimum number of 24 hour days elapsed after depositing.
Posts under beams and girders	20
Floor slab panels	10
Wall forms	2
Column forms	4
Sides of beams and girders	4
All other parts	10

2. Clauses and parts of clauses on Concrete Joints.

Part of Clause 52. Concrete shall be deposited in approximately horizontal masses, and the work shall be stopped only at regular or temporary vertical bulkheads.

"Arch rings shall be built in sections of such length as will permit of all concrete in any one section being placed without stopping. If circumstances render this impracticable, bulkheads shall be placed normal to the line of pressure."

"In building bench walls of abutments of arches the tops of such walls shall be finished normal to the line of pressure, and no horizontal joints shall be made."

Trowelled or floated horizontal surfaces shall be not less than one inch in thickness.

Part of Clause 61. In depositing concrete in columns the work shall be discontinued at the elevation of the bottom of beams for a period of not less than three hours before depositing the beam concrete. In the absence of beams the elevation of the bottom of the slab shall be taken at the stopping plane.

The concrete for slabs shall be deposited continuously with the beams. Special care shall be exercised to procure perfect homogeneity of tee-beam construction.

Clause 62. Every structural element shall be completed without discontinuance if practicable. Unless completed in one operation beams and slabs shall be discontinued only by the use of vertical bulkheads placed at the section of maximum bending moment.

SCHEDULE "B".

Suggested clauses to replace those of Schedule "A".
Note: — All words followed by an asterisk should be defined preferably in the first clause of the Specifications.

Specifications upon timber foundation piles not here included.

1. Forms*.

Plans of Forms.

1. Plans of the forms or of such parts of the forms as were not prepared by the Engineer and constitute part of the Contract* shall be prepared by the Contractor and shall show all necessary dimensions and shall be submitted to the Engineer* and receive his written approval before the work of building them begins in order to avoid as far as possible the condemning of forms after they have been made. The Engineer, shall return such plans approved, disapproved, or amended within 5 days after their receipt. The constructed forms shall conform to the designs as finally approved.

Loads.

2. Forms shall be designed to bear the following loads: 150 lbs. per cu. ft. of concrete, 4 lbs. per ft. B.M. of timber, 50 lbs. per sq. ft. of exposed surface (vertical surfaces or the vertical projections of oblique surfaces) for wind, and such other dead and live loads as may be imposed upon them.

Forms shall be designed to retain the concrete considered as a liquid load for such depth as the Contractor proposes to place in one-half day, and this rate of concreting shall not be exceeded without strengthening the forms accordingly. (See Appendix A.)

Unit Stresses in Timber.

3. Stresses in timber for forms or caissons shall not exceed the following:

	Beams.	Columns.
	Extreme fibre stress per sq. in.	Compression per sq. in.
White Oak, Long Leaf Yellow Pine, Douglas Fir................	1500 lbs.	$1500\left(1-\frac{L}{60d}\right)$ lbs.
White Pine, Norway Pine, Hemlock Spruce................	1200 lbs.	$1200\left(1-\frac{L}{60d}\right)$ lbs.

Where L is the length of timber in inches center to center of bearings and d is the least diameter in inches.

Tightness.

4. The materials and workmanship of the moulds* shall be such as to prevent leakage of mortar or water.

Accuracy.

5. Forms shall be made with such accuracy that no variations in the finish work from the lines shown or indicated on the Plans shall exceed the proportion of one-half inch in 100 feet and no variations from correct dimensions shall exceed one quarter inch, except only on concrete which will not be exposed, such as the backs of walls and concrete below low water level*.

6. In designing centering* a settlement of ½ in. for each 30 feet of vertical height shall be allowed for.

Accuracy of Butt Joints.

7. Shimming up butt-joints will not be permitted. Abutting ends shall be sawn so as to bear evenly without shims over the whole section, (but for heavy wedges see Clause 11).

Timber Joints in Main Members.

8. Butt-joints or bolted joints shall be used for centering in all main members. No reliance will be placed in spikes to carry calculated stress.

Moulds.

9. Timber moulds* for exposed surfaces shall be made of matched boards of uniform width for each part of the work, and if less than 1¾ inches in thickness (after dressing) tongue-and-grooved. Unless a rough surface is specified (by bush-hammering or otherwise) the forms shall be dressed, and after erection uneven joints shall be planed flush.

Timber for Moulds.

10. Timber moulds for exposed surfaces shall be made of pine, spruce or other approved timber, but other timber may be used for the backs of walls and for forms other than moulds.

Wedges.

11. Wedges shall be made of straight grained white oak.

Lowering of Centers.

12. Centering* for arches and beam superstructures shall be designed to be lowered by the removal of heavy wedges or by other devices to avoid raising or otherwise damaging the concrete during the removal of the centering.

Tamping Sills.

13. If mud sills are used under centering, after the forms for superstructures are completed and the reinforcing is in place and before concrete is placed the mud-sills shall be tamped with an approved two-man beetle until no further settlement takes place. If an extra load is required by the Special Specifications or is shown on the Plans* it shall be evenly distributed over the superstructure previous to tamping.

Soapy Covering.

14. The moulds shall be brushed with a coat of approved soapy water or approved form oil before concrete is placed in them.

Cleaning.

15. Moulds shall be provided with doors so placed as to permit of the moulds being thoroughly swept and cleaned as this will be required of the Contractor before concrete is poured.

Time of Removal.

16. Centering shall remain in place at least one month after the concrete has been placed, except for slabs under 8 in. in thickness, the centering for which shall remain in place at least two weeks, and forms for the sides of columns, ties, beams and side forms generally shall remain in place for at least 4 days, except for walls and sides of separately moulded small parts such as handrail parts which shall remain in place for at least 2 days, but no centering or other forms shall be removed without the approval of the Engineer, and then at the Contractor's risk.

Old Forms.

17. Lumber once used for moulds shall be cleaned, and treated as mentioned in Clause 14, before being used again.

Approval.

18. Forms in place shall be approved* before concreting begins.

Concrete Joints*.

Cleaning Surfaces.

19. At concrete joints* fresh concrete shall be placed only on clean surfaces. The old concrete shall be scrubbed if necessary to clean it.

Wetting and Cementing.

20. At horizontal joints immediately before fresh concrete is placed the entire surface to be covered shall be sprinkled with dry cement, the old concrete having previously been saturated with water.

Vertical and Oblique Joints.

21. At vertical concrete joints, after the removal of the bulkheads at least one-third of the surface of the old concrete shall be picked off unless at least one-half of one per cent of the section is steel, or unless approved keys or groves have been allowed*.

Joints in Beams.

22. Horizontal concrete joints will not be allowed in beams and slabs not between beams and slabs; joints shall be vertical and midway between the permanent supports.

The above applies to the usual case where beams and slabs are horizontal. Where they are inclined to the horizontal the joints shall be inclined to the same extent to the vertical and clause 22 shall apply as in vertical concrete joints.

Radial Joints.

23. In arch abutments and arch rings or ribs, concrete joints shall be in planes perpendicular to the dead load line of resultant pressure. In arch ribs or rings, (in other words) the bulkheads shall be

approximately perpendicular to the soffit. The sections between bulkheads in concrete ribs shall be concreted in the order indicated by numbers on the Plans. If not thus shown on the Plans, in arches of more than 80 ft. clear span (measured parallel to the handrail) the Contractor shall furnish to the Engineer for approval a diagram showing the order of concreting voussoir sections and in arches of less than 80 ft. in span concreting these sections shall begin simultaneously at both skewbacks, and proceed from both regularly and equally to the crown.

Joints in Walls.

24. Any concrete joints in walls* (except arch abutments) shall be horizontal or vertical, or both, but never oblique nor irregular.

Joints over Columns.

25. Concrete joints shall always be made between the tops of walls or columns and the beams or slabs resting upon them (to allow for shrinkage in setting).

Top Courses.

26. Horizontal joints in walls (except as referred to in the proceding clause) will not be allowed within 6 in. of the top, as no reliance will be placed in thin surface courses laid on set concrete.

Joints in Handrails.

27. No vertical joints will be allowed in concrete handrails except expansion joints as shown on the Plans*.

No Joint Marks in Face Work.

28. In walls or columns where the edge of a concrete joint meets an exposed surface this edge shall be made in a level straight line. Directly before laying fresh concrete the wires or bolts holding the moulds together just above the joint shall be tightened. Mortar shall be laid along the corner or edge of the exposed surface before the rest of the surface is covered with concrete and shall be tamped and spaded with a trowel into the corner.

Bulkheads.

29. All concrete joints except horizontal joints shall be moulded by bulkheads, except for the lower joints in arch abutments if the obliquity of the joint is slight and if the concrete is dry enough to retain the proper surface inclination without bulkheads. A bulkhead shall cover the entire section of concrete; or if it does not extend below the lower reinforcing steel so that the concrete runs out irregularly under it, this concrete shall be chipped off before taking its final set to approximately the required plane.

Joints Trusses.

30. But joints in the lower chords of concrete trusses need not be vertical nor regular, but the concrete will not be allowed to run out to thin edges.

Excuses.

31. Rain, the approach of night, or any other cause shall not be considered a valid reason for making a concrete joint at any other place or in any other way then as above specified.

On the Economics of Building Design

An analysis of the cost of the elements entering into the construction of reinforced concrete building.

J. Morrow Oxley, A.M.E.I.C.

Paper Presented at the General Professional Meeting, Toronto, February 2nd, 1921.

General Idea

The purpose of this study is to express graphically and by tables the relative effect on cost of variations in the proportions, dimensions and floor loading for the standard type of building considered.

The method employed is to study first the main elements individually, then to combine them into a complete building, and finally to make applications to specific problems. Only the structural elements are considered in the present study, but it is hoped that at an early date a similar analysis of the mechanical elements will be made. The latter are not of as great importance for comparative purposes as the former, as the items of heating, plumbing, lighting and sprinkler equipment vary almost directly with the cubical contents or floor area of the building, and elevators are the only mechanical item of which the relative cost varies greatly for changes in the height of the building.

Type of Building

The type considered is a flat slab reinforced concrete building, with brick spandrel walls, solid metal sash glazed with clear glass, concrete coping and sills, cast in place, five ply felt and gravel roof, cement finish on floors, and reinforced footings resting on firm soil. This type was chosen for the first study as one that is well standardized in both general and detail construction and readily adaptable to practically all classes of light manufacturing and storage occupancy. It was hoped to make a similar analysis of a standard mill construction building in brick and timber, but time did not permit for the present paper, and this may be submitted at a later date.

Design

The slab design is based on the Chicago Building By-law Regulations of January 1st, 1918, with a slight modification of the bending moments in the slab justified by more recent analysis of the conditions. Columns and footings are designed according to the report of the American Joint Committee on Reinforced Concrete 1916. The above specifications were chosen as it was considered that on the whole they have met with a more general acceptance than any others available, although it must be admitted that the whole question of reinforced concrete design is still subject to refinement and development and it may be several years yet before we reach the same state of standardization and general acceptance as we have attained in the use of some other materials.

The working unit stresses and moment constants used are tabulated below.

Unit Stresses Employed

Footings

Pressure on soil = 4 tons per sq. ft.
Punching shear on conc. = 120 lbs. per sq. ins.
Tension on steel = 16000 " " " "
Bond on steel (deformed) = 100 " " " "

Columns

1–2–4 mix (unhooped)
Comp. on conc. = 450 lbs. per sq. ins.
Comp. on steel (n = 15) = 6750 " " " "

1–1–2 mix (hooped)
Comp. on conc. = 1050 lbs. per sq. ins.
Comp. on steel (n = 10) = 10500 " " " "

Slab and Beams (1–2–4 mix)

Comp. on conc. = 750 lbs. per sq. ins.
Tension on steel = 18000 " " " "
Diag. tens. on conc. = 60 " " " " (on vert. sect. bjd)
Punch. shear on conc. = 120 lbs. per sq. ins.

$$n = \frac{E_s}{E_c} = 15$$

d = effective depth.
k = depth to neut. axis = 0.384 d
j = centroid comp. to centroid tens. = 0.872 d
Moment of resistance conc. = 126 bd^2
Moment of resistance steel = Area steel × 15700d

MOMENT CONSTANTS

W = Total live and dead load on panel.
W_1 = Total live load only on panel.
L = Panel length c. to c. columns.

Type of Panel	Half panel width centered at column		Half panel width centered at mid-span	
	Neg. mom. over col. capital	Pos. mom. at mid-span	Neg. mom. over straight band	Pos. mom. at mid-span
Interior..........	$\frac{WL}{30}$	$\frac{WL}{75}$	$\frac{WL}{125}$	$\frac{WL}{125}$
Wall panel supported on conc. cols. and girders	$\frac{WL}{30}$	$\frac{WL}{60}$	$\frac{WL}{125}$	$\frac{WL}{100}$

Moment Constants on Columns

Int. column carrying roof........	$\frac{W_1L}{30}$
Int. column carrying floor.......	$\frac{W_1L}{60}$
Wall column carrying roof.......	$\frac{WL}{30}$
Wall column carrying floor......	$\frac{WL}{60}$

Method of Analysis

All costs noted represent total cost to the owner of the building. Except for the items of some of the individual elements, costs are expressed in relation to the square foot of floor area as it is believed that this gives a more useful and commercially applicable result than the cubic foot basis. Except for buildings of the one storey mill type where the cost of walls is a relatively large part of total cost, it is considered that cost figures based on floor area are a truer index than those based on cubic contents.

The unit prices used in compiling the tables and diagrams are tabulated below. They are based on tenders received for various buildings in Toronto in the fall of 1920. Of course with changes in the prices of materials and labor these unit prices would vary, but as the purpose of the present analysis is to show the *relative* not the *absolute* costs of the features considered, the unit prices are of secondary importance as long as their relation one to another is approximately correct. This feature will be dealt with later in the form of an "index" figure which may be used to arrive at absolute costs in spite of variations in unit prices.

Unit Costs Employed

Flat Slab Const.

6" to 9" Slab.	Con.	per cu. ft.	$0.540
	Steel	per lb.	.08
	Forms	per sq. ft.	.30
Cols. Conc. Per cu. ft.	1–2–4		.54
	1–1½–3		.59
	1–1–2		.64
Col. Forms,	drop		9.25 ea.
	cap		3.90 ea.
Per sq. ft.	square		.25
	oct.		.30
	round		.30

Concrete Floor Finish

Laid with slab	¾" thick	.072
Laid after	1½" "	.09
Brick spandrels	9" thick	.64 per super. ft.
	13½" "	.88 " " "
Roofing	per sq. ft.	0.165
Flashing	per lin. ft.	0.465
Coping	" " "	0.465
Sills	" " "	0.35
Sash	in place, clear glazed	.85 per sq. ft.
	with wire glass	1.05 " " "

Ground Floor

Finish	per sq. ft.	$0.07
5" Conc.	" " "	.23
4" Cinders	" " "	.08
Grading	" " "	.03
		.41

Footings

Exc.	3.00 per cu. yd.
Conc.	.50 " " ft.
Forms	.20 " " "
Steel	.075 per lb.

The results deduced will apply in a general way to several other types of building, but as these other types are usually more specialized for some particular occupancy they are not susceptible to the same detailed analysis as the two types above mentioned.

A typical section of one building has been worked out in detail and by the use of the diagrams corresponding cost items may be found for other buildings of different heights, panel sizes and floor loadings. The building chosen for detailed study has panels twenty feet square, live load on floors of two hundred pounds per sq. foot, a storey height of twelve feet and is eight storeys high. A partial cross section and floor plan with some particulars as to reinforcement, etc., are shown in Figs. 1 and 2.

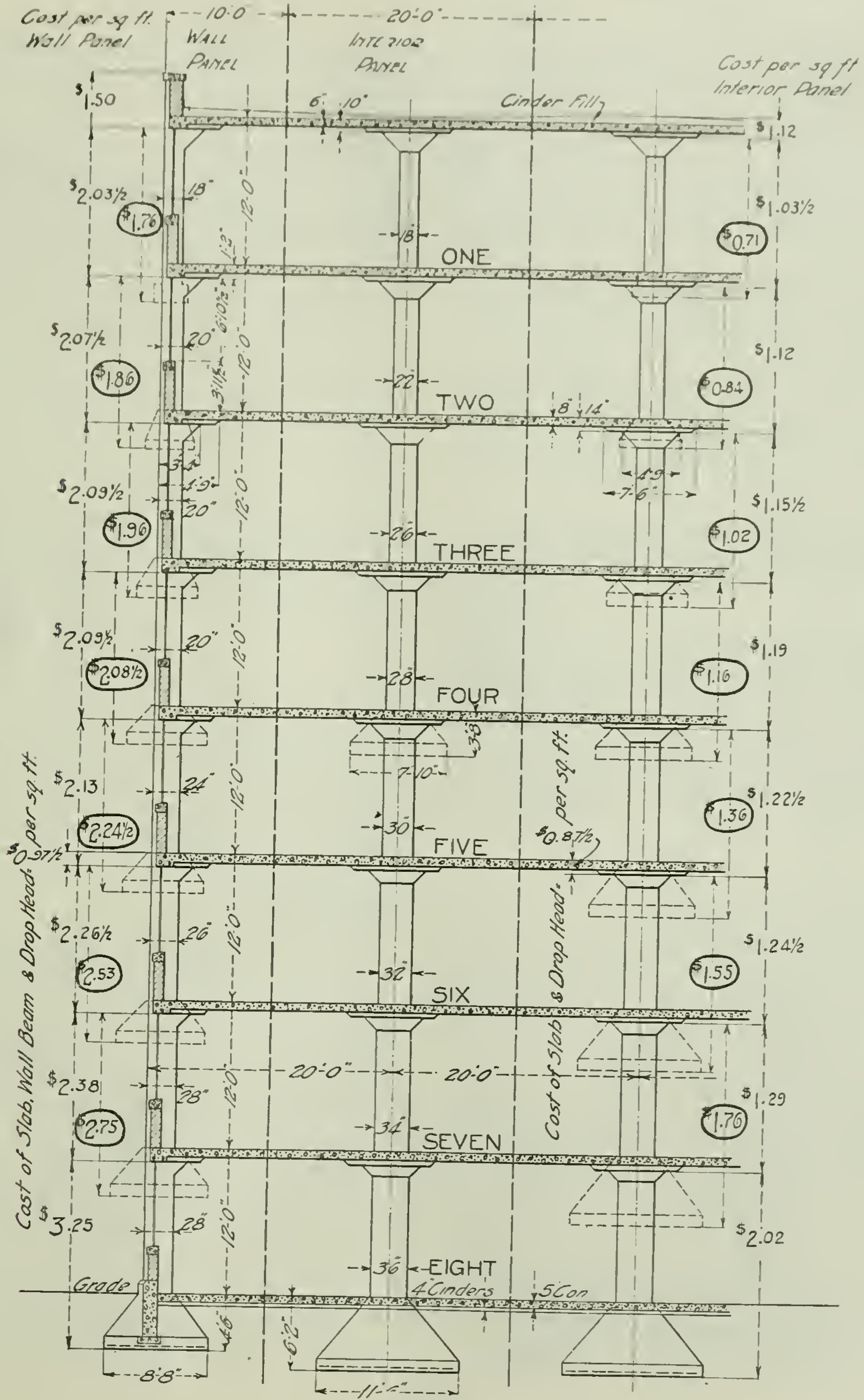
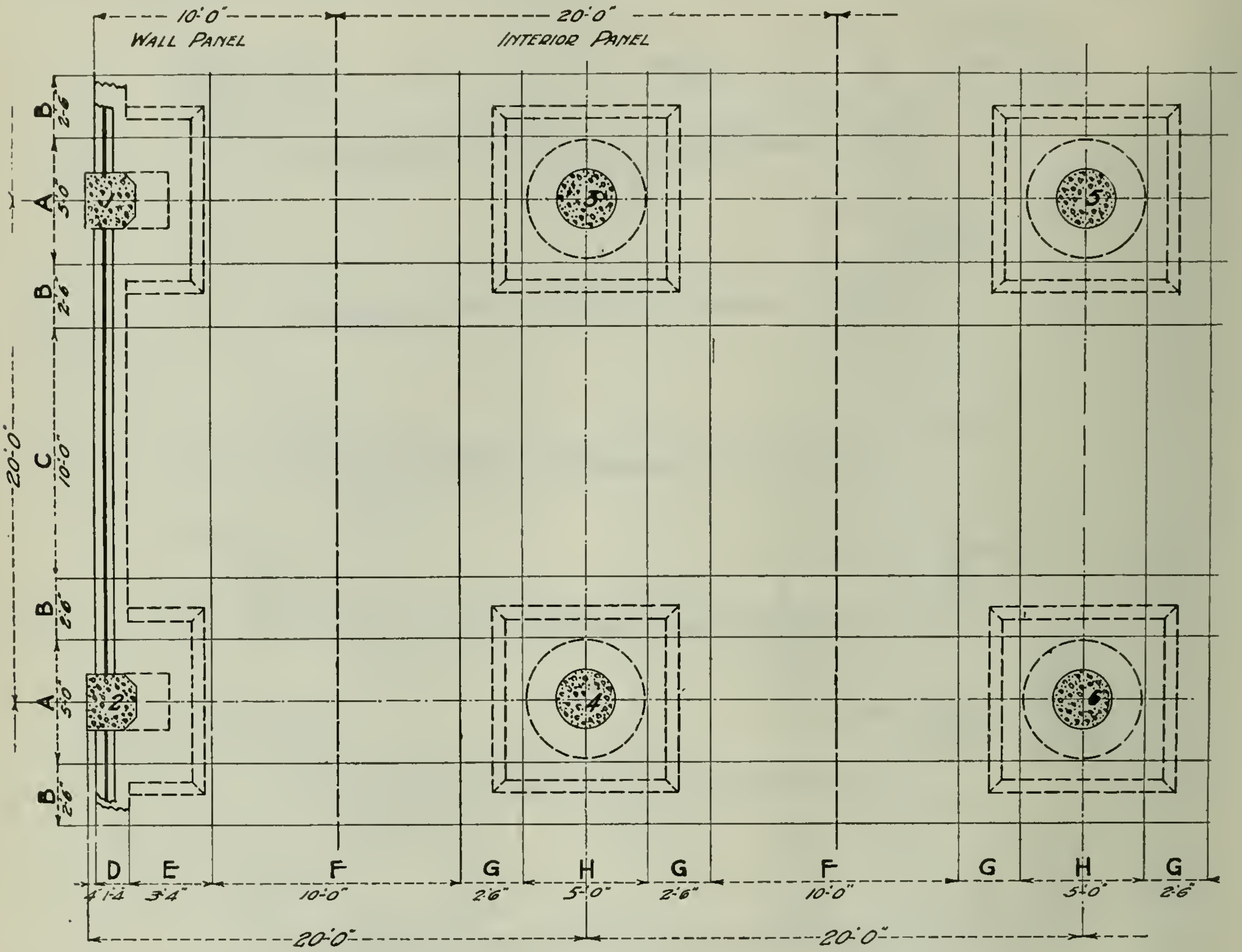

Cost per sq ft. Wall Panel
10'0"
WALL PANEL
20'0"
INTERIOR PANEL
Cost per sq ft Interior Panel
6"
10"
Cinder Fill
$1.50
$1.12
$2.03½
$1.76
18"
12'0"
18"
ONE
$1.03½
$0.71
$2.07½
$1.86
20"
6'0⅞"
3'1¼"
22"
TWO
8"
14"
$1.12
$0.84
4'9"
7'6"
$2.09½
$1.96
20"
26"
THREE
$1.15½
$1.02
$2.09½
$2.08½
20"
28"
FOUR
3'8"
7'10"
$1.19
$1.16
$2.13
$2.24½
24"
30"
FIVE
$0.87½
$1.22½
$1.36
$0.97½
$2.26½
$2.53
26"
32"
SIX
$1.24½
$1.55
20'0"
20'0"
$2.38
$2.75
28"
34"
SEVEN
$1.29
$1.76
$3.25
28"
36"
EIGHT
4" Cinders
5" Con
$2.02
Grade
4'6"
6'2"
8'8"
11'6"
Cost of Slab, Wall Beam & Drop Head per sq. ft.
Cost of Slab & Drop Head per sq. ft.

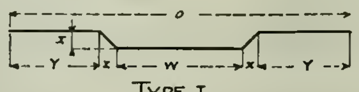
Figure 1



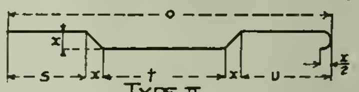
PLAN OF TYPICAL PANELS

DETAIL OF SLAB REINFORCEMENT

NOTE:- Z is total length of material in any Type



TYPE I



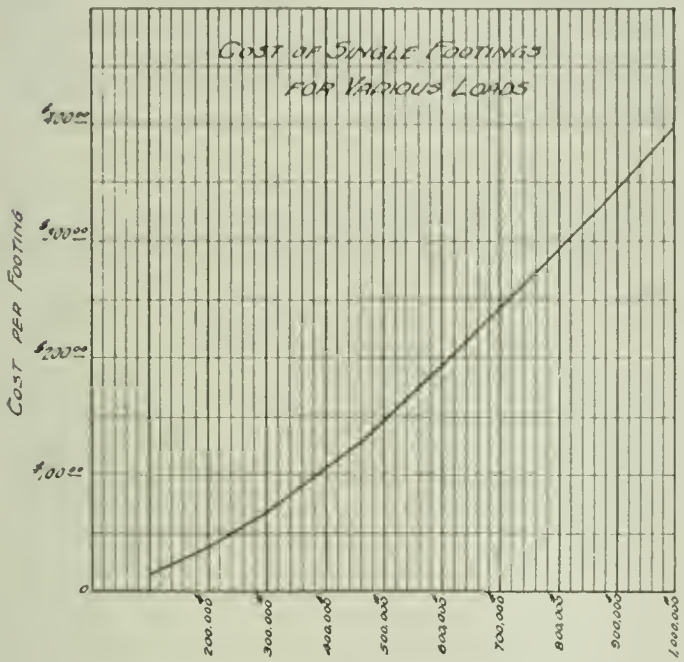
TYPE II

SLABS																					
Location of Panels by Columns	Thickness of Slab	Type of Rod	Number of Rods per Strip																		
			A	B	C	D	E	F	G	H	Y	X	W	O	S	t	U	Z	Size	Total No. per Panel	Weight
Wall Beam	14"	I				3					7'-8"	10"	11'-0"	28'-0"				28'-9"	7/8" □	3	224
		Strit.				2												20'-0"	7/8" □	2	104
Stirrups	14"					6												4'-0"	3/8" φ	6	10
1-2-3-4	8"	I					2	5	2	4	9'-10"	5½	9'-6"	30'-1"				30'-6"	½" φ	13	264
		II	9	2	6							5½		24'-7"	9'-10"	9'-6"	4'-4"	25'-6"	½" φ	19	323
		Strit.	2	2	7													16'-0"	½" φ	13	139
		Strit.	7	2														5'-6"	½" φ	11	40
		Strit.					2	6	1	1								13'-6"	½" φ	10	90
	Spacing		17 @ 3½"	6 @ 5"	14 @ 8½"	4 @ 2½"	4 @ 10"	12 @ 10"	3 @ 10¼"	9 @ 6½"											
3-4-5-6	8"	I	8	4	5			5	4	8	9'-10"	5½	9'-6"	30'-1				30'-6"	½" φ	34	692
		Strit.	2	2	6			6	2	2								13'-6"	½ φ	20	180
	Spacing		9 @ 6½"	3 @ 10¼"	12 @ 10"			12 @ 10"	3 @ 10¼"	9 @ 6½"											

Figure 2

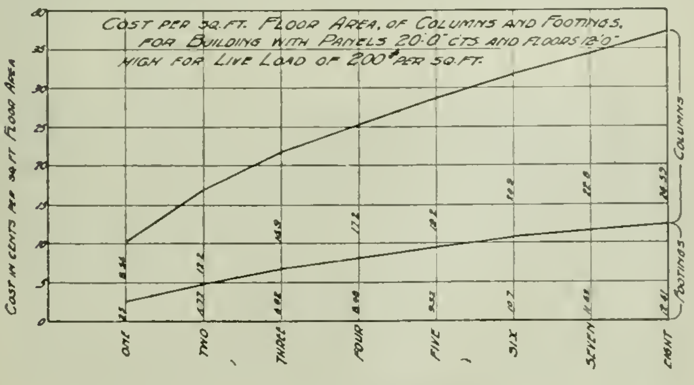
Footings

The cost of footings, including excavation, has been computed in relation to the column load. Fig. 3 shows these costs in terms of total cost of single footings for a given column load, and Fig. 4 shows them combined with columns in terms of cost per square foot of floor carried.



Loads
Figure 3

It was found that except for the very light loads the depth of footing was determined by the unit stress in punching shear, which was measured on a cylinder of the perimeter of the column. Bond stresses were figured from vertical shear and necessitated the use of rods smaller than base price sizes up to column loads of about 850,000 lbs. Some discussions which have appeared in the technical journals since the preparation of these diagrams might justify the use of a truncated cone section instead of a cylinder as the criterion for punching shear, and permit of a more even distribution of bond stress over the length of the rod. Both these points would tend to reduce the cost of the footings somewhat.



Number of storeys
Figure 4

Columns

A comparison of the relative values of different types of columns was made to show definitely the advantage of using a hooped column and a rich mix. This is based on twenty-four inch columns with one per cent longitudinal steel and hooping equivalent to one per cent of the volume of the enclosed concrete. The concrete outside the steel is not considered as effective section. Costs are stated in terms of the cost in cents, of carrying a load of one thousand pounds a vertical distance of one foot. The weight of column is given in the same terms.

These tabulations, given below, show the economic value of using hooping and a rich mix, particularly in a high building, where the weight of the column itself will be an important item as the lower storeys are reached. This table shows that for a given load carrying capacity the type of column that a few years ago was considered standard, not only costs 71% more than the minimum type but also weighs more than twice as much. It also shows, by means of the items for an additional one per cent of longitudinal steel, the relative extravagance of using more steel than the allowable minimum.

The item of cost for the additional one percent of longitudinal steel is the cost per 1000 lbs. for the *additional* load which the more heavily reinforced column is capable of carrying.

Of course the necessity of keeping columns within a reasonable size, and, in some cases, the provision for bending moments, will frequently make it advisable to use more than the minimum of steel. In one building for which the general cost amounted to about $2.50 per square foot it was found that the addition of sufficient steel to keep the maximum column size down to twenty-four inches amounted to $20.00 per square foot of floor space gained.

Cost of Columns of Various Types

Type	Mix	Weight per ft. per 1000 lbs carried	Cost per ft. per 1000 lbs carried	% of min'm. cost
24" dia. Round Hooped Long Steel = 1%	1–1–2	1.27 lbs.	1.58 cents	100
	Add. 1% steel		2.7 cents	
	1–1½–3	1.49	1.81	114.6
	Add. 1% steel		2.66	
	1–2–4	1.81	2.15	136.0
	Add. 1% steel		2.61	
24" sq. Ties @ 12" ctrs. Long Steel = 1%	1–1–2	2.04	1.95	123.5
	Add. 1% steel		4.2	
	1–1½–3	2.40	2.21	140.0
	Add. 1% steel		4.12	
	1–2–4	2.95	2.70	171.0
	Add. 1% steel		4.05	

Slabs

For purposes of comparison a table has been compiled showing the cost per square foot of slabs composed of various concrete mixes, see table below. This table is based on a slab or beam designed for a given live load, and as the dead load increases with the greater depth of slab required for the leaner mixes the total bending moment increases correspondingly.

An application may be made of the tables to find at what height above footings it would pay to use a richer mix for the slab than the normal 1–2–4.

Consider a panel 20 ft. square, area 400 sq. ft. A slab of 1–1½–3 mix would cost 400 × 1.1 cts. = $4.40 more than one of the same strength in a 1–2–4 mix, but would weight 400 × 8 = 3200 lbs. less. The saving in column cost per foot of height would be 1.58 × 3.2 = 5.06 cts.

So at a column height of $\frac{440}{5.06} = 87$ ft. the saving in column cost would balance the higher slab cost, and at any height above this there would be some economy in using the richer mix for the slab.

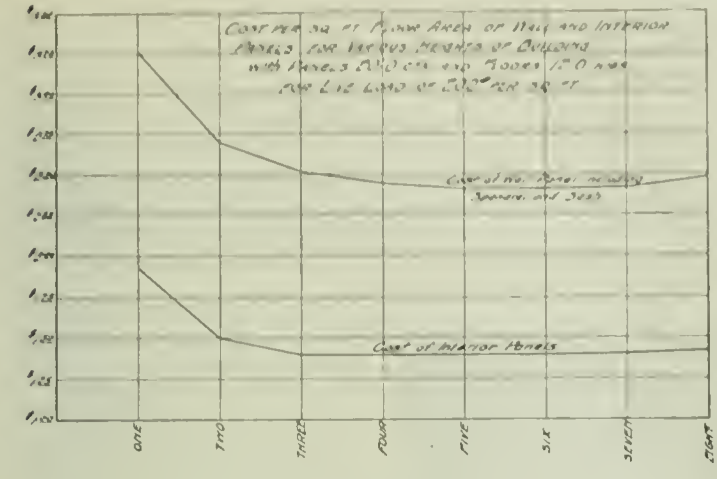
Application to Complete Building

The curves of Figs. 5 and 6 represent costs computed for what may be considered an average type of building as illustrated by Figs. 1 and 2. These curves cover the range of probable variations in width and number of storeys. They are prepared from the amounts shown on Fig. 1 which, it will be noted, are in two series. The items on Fig. 1, enclosed in the rings represent the square foot cost for each tier when it becomes the lowest storey of the building, while the unenclosed items are for the tier when it is an upper storey.

The method of computing these items was first to work out the actual costs of an eight storey building. Then for each floor in turn the saving in floor slab construction is deducted, and the footing cost is added, to arrive at the unit cost when the floor in question is considered as the ground floor. Thus to arrive at the average cost of, say, the wall panel of a four storey building we add together the unenclosed figures for roof, one, two and three storeys and the enclosed figure for the fourth or ground floor totalling $9.79. Divide the sum by the number of storeys, four, and we have the average cost per square foot, equals $2.45.

Cost of 1 Sq. ft. of Slab Designed for B.M. from L.L. of 200 lbs per sq. of 30,000 lbs on strip 12" wide

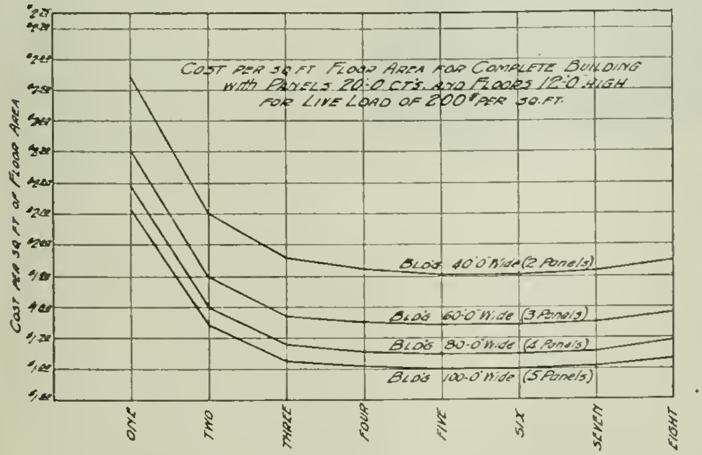
Mix	Total B.M. LL + DL	$d=\sqrt{\frac{BM}{12\,RM^C}}$	Wt. of slab per sq. ft.	Concrete in cu. ft.	Steel sq. ins.	Conc. + steel	Finish & forms	Total cost in cts. per sq. ft.	% of min. cost.
1-3-6	30000 16500	7.85 (+ 1")	110 lbs	0.74 @ 48¢.	0.376 @ 27¢.				
	46500			= 35.5	10.2	45.7	37	82.7	105.2
1-2½-5	30000 13500	6.35 (+ 1")	92 lbs	0.61 @ 50¢.	0.425 @ 27¢.				
	43500			= 30.5	11.5	42.0	37	79.0	100.6
1-2-4	30000 12000	5.27 (+ 1")	78 lbs	0.52 @ 54¢.	0.505 @ 27¢.				
	42000			= 28	13.6	41.6	37	78.6	100
1-1½-3	30000 10500	4.65 (+ 1")	70 lbs	0.47 @ 59¢.	0.56 @ 27¢.				
	40500			= 27.6	15.1	42.7	37	79.7	100.7
1-1-2	30000 9500	4.20 (+ 1")	65 lbs	0.433 @ 64¢.	0.605 @ 27¢.				
	39500			= 27.6	16.3	43.9	37	80.9	103.0



Number of storys.
Figure 5

The wall panel has been considered as extending only to the mid-span. This gives a convenient arrangement, as then an interior panel may be considered as the area centred on a single column, and any number of interior panels may be added to two wall panels to produce the total for any width of building. In the costs for the wall panels are included the costs of the extra steel in the slab required for the greater bending moment, the wall beam, the brick spandrel, and the sash.

The cost per sq. ft. of a corner panel, which has an area equal to one-half that of an ordinary wall panel, but a wall length and column cost equal to that of a wall panel, will be very nearly the same as the sum of the wall and interior panel costs for the corresponding floor. Thus for a four storey building the square foot costs of wall and interior panels taken from Fig. 5 are $2.45 and $1.40 respectively. The sum of these gives us $3.85 per sq. ft. The area of the corner panel will be 10′ × 10′ = 100 sq. ft. per floor, and this item may be added to the amounts made up from complete wall and interior panels to get the total for the whole building.



Number of storys.
Figure 6

The applications of these curves may be made clearer by consideration of a practical case.

An owner requires 256,000 sq. ft. of space for light manufacturing, of which he wants one half built at present and the remainder at some future date. The building has unobstructed light from both sides and so may be fairly wide, say 80′0″. Compare two possible solutions.

Case I — Building 80′ wide, 400′ long, four storeys high, designed for a future addition of four storeys.

Case II — Building 80′ wide, 200′ long, eight storeys high, with provision for an extension at one end of 200′ long.

For Case I we shall have to go back to the table of unit prices for the items of parapet and the temporary roofing and fill. The cost of the top floor slab without finish, columns or walls, and the items for interior and wall panels for the one, two, three and four tiers, counting from the top, will be found on Fig. I. The two cases may then be tabulated as follows:—

Case I

Roofing	560 lin. ft. parapet	@ $2.38	=	....	$ 1334.00
	560 " " flashing	@ .46	=	....	258.00
	32000 sq. ft. roofing	@ .16½	=	....	5280.00
	32000 " " fill	@ .20	=	....	6400.00
					$13272.00

Tiers	Costs in Panels		
	Interior	Wall	Corner
Top........	$ 0.87½	0.97½	1.05
One........	1.22½	2.13	3.35½
Two........	1.24½	2.26½	3.51
Three......	1.29	2.38	3.67
Four.......	2.02	3.25	5.27
Totals......	$ 6.65½	11.00	16.85½
×			
Area.......	22800	8800	400
Amount....	$151734.00	$96800.00	$6742.00

Total for floors (everything below roofing)............. 255276.00

Total for building.. $268548.00
Total area 128000 sq. ft.
Cost per sq. ft. = ... $2.10

Case II

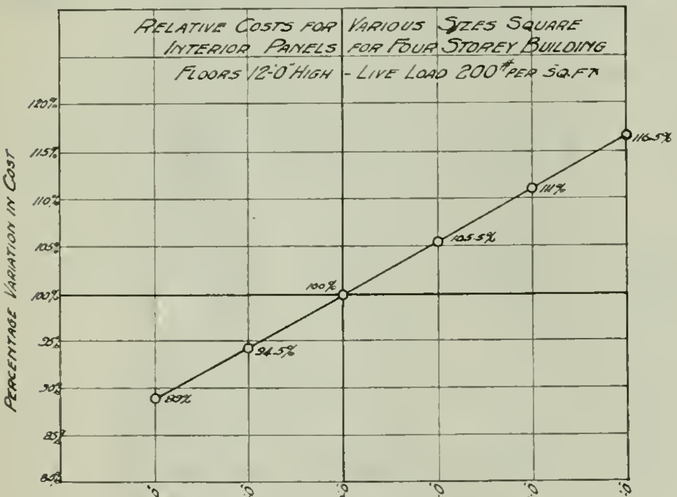
With the exception of the end wall panels this may be taken directly from Fig. 6 where we find the cost for an eight storey building 80′0″ wide to be $1.69 per sq. ft.

Floor area, omitting end wall panels is 80 × 180 × 8 = 115,200 sq. ft. @ 1.69 = ...	$194,688.00
6 end wall panels give an area of 10 × 20 × 6 × 8 storeys = 9600 sq. ft. @ 2.48 =	23,608.00
And 4 corner panels give 10 × 10 × 4 × 8 storeys = 3200 sq. ft. @ 3.90½ =	12,496.00
Total cost	$230,792.00
Total area 128.000 sq. ft.	
Cost per sq. ft. = ...	$1.80

Thus it is found that Case I will cost 30¢. per square foot or nearly 17% more than Case II. Another point to be considered is that the roofing on Case I will have to be discarded before having given full service if the addition is made in a few years, while in Case II it will probably be desirable to retain the end wall as a fire wall even when the addition is made.

Effect of Live Load on Cost

Fig. 7 show the effect of variation in live load on the cost of a typical interior panel including columns and footings, in a four storey building. It will be noted that the relative costs are given in percentages referred to.the typical building shown in Figs. 1 and 2 and for which we can get dollars and cents costs from Fig. 6.

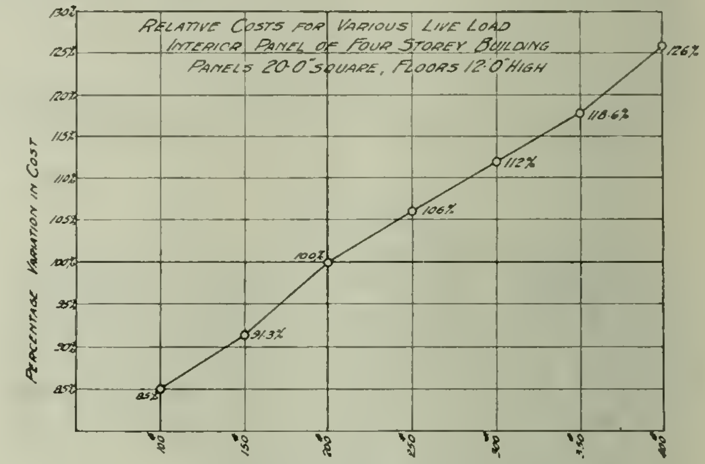


Live load - per square foot
Figure 7

It is interesting to note what a relatively small increase in costs is caused by a large increase in load carrying capacity.

Effect of Variation in Panel Size

Fig. 8 shows the effect of variation in panel size on the cost for interior square panels, including columns and footings. The percentages on this Figure are also referred to the costs on Fig. 6.



Side of square panel C to C Columns
Figure 8

By the use of Figs. 6, 7 and 8 it is possible to compare the cost of any probable combination of length, width, and number of storeys for the type of building considered, and find without great labour, the most economical solution of the problem of supplying an owner with a given amount of floor area. Or they may be applied to balance the cost of various solutions against other considerations, such as the cost of land available, the size and usable area of the lot, architectural considerations, effect of width on natural lighting and so on.

As stated earlier, the dollars and cents costs may not be of direct application owing to the continuous variation in material and labor prices, and the eagerness or otherwise of contractors to take on a job, but it is hoped that the *relative* costs may be of some use to others as they have been, in a cruder form, to the writer.

JOHN MORRICE ROGER FAIRBAIRN, M.E.I.C.,

PRESIDENT

The Engineering Institute of Canada.

John Morrice Roger Fairbairn, president elect of **The Engineering Institute** of Canada, although still a comparatively young man, occupies a position of premier importance and responsibility in the engineering world. His election to the presidency of **The Institute** is a tribute alike to his high engineering attainments and to those superior manly qualities which are appreciated by all who know him

Mr. Fairbairn was born at Peterborough on June thirtieth, eighteen hundred and seventy-three, and was educated in private school and in the high school of his native city, before commencing his course in civil engineering at the School of Practical Science in Toronto, in October eighteen hundred and ninety. Like all other successful engineers, his summer vacations while attending college were taken up with practical engineering work. Two summers were spent with the late George W. Ranney, C.E. on surveys and in getting out plans for the construction of the Irondale, Bancroft and Ottawa Railway. The following vacation was spent as leveller and topographer on preliminary and location surveys for the Peterborough, Parry Sound and Sault Ste. Marie Railway, under the late W. A. Ramsay, chief engineer of construction for the Canadian Pacific Railway. Thus, Mr. Fairbairn's connection with the company in which he now occupied so eminent a position goes back twenty-nine years.

JOHN MORRICE ROGER FAIRBAIRN, M.E.I.C.,
President
The Engineering Institute of Canada.

After graduating in civil engineering in May, eighteen hundred and ninety-three, his first position was with the Department of the Interior as principal assistant to Fred. W. Wilkins, Dominion topographical surveyor on surveys in Alberta, and later in the same year he was with the Department of Railway and Canals, draughting. Part of eighteen hundred and ninety-four was spent with the Department of Militia and Defence as principal assistant to Fred. W. White, chief engineer of the Department, and the remainder of the year with the Department of the Interior as principal assistant to Fred. W. Wilkins, D.T.S. on trail location surveys in Southern Alberta. The following year was spent partly with the Department of Railways and Canals as transitman on contour surveys of Balsam Lake, under R. B. Rogers, M.E.I.C., superintending engineer, and the balance with the Department of Militia and Defence, as principal assistant to Fred. W. White, chief engineer. Following a short period with the Department of Railways and Canals as transitman on right of way surveys, he became engineer in charge of construction of Lachine and St. Laurent lines of the Montreal Park and Island Railway. During the greater part of eighteen hundred and ninety-seven Mr. Fairbairn was principal assistant to Chas. A. Stoess, on mining claim and land grant surveys in the Slocan District, B.C., and until March eighteen hundred and ninety-eight was engaged in surface and underground surveys of various mining properties, during which time he acted as city engineer of Kalso, B.C.

Mr. Fairbairn then entered private practice, which he followed up as civil and mining engineer and provincial land surveyor at Kalso, B.C., and Greenwood, B.C. In April, nineteen hundred, Mr. Fairbairn joined the construction department of the Canadian Pacific Railway as leveller on grade reduction surveys between Winnipeg and Fort William, under W. F. Tye, M.E.I.C., chief engineer of construction. From August of that year until August nineteen hundred and one he was with the Department of Railways and Canals as engineer in charge of section 3, Simcoe-Balsam Lake Division, Trent Canal, under R. B. Rogers, M.E.I.C., superintending engineer. Since August nineteen hundred and one Mr. Fairbairn's association with the Canadian Pacific Railway has been continuous as follows: Principal assistant to D. McPherson, Division engineer at Montreal, August nineteen hundred and one to November nineteen hundred and two. Resident engineer at Ottawa, November nineteen hundred and two to August nineteen hundred and four. Assistant engineer in chief engineer's office, Montreal, August nineteen hundred and four to August nineteen hundred and five. Acting division engineer, Eastern Division August nineteen hundred and five to March nineteen hundred and six. Division engineer, Ontario at Toronto, March nineteen hundred and six to November nineteen hundred and seven. Division engineer, Eastern Division at Montreal, November nineteen hundred and seven.

Next year his ability was recognized by his appointment as principal assistant engineer followed by engineer, maintenance of way in 1910, and later assistant chief engineer. On July first, nineteen hundred and eighteen, Mr.Fairbairn was appointed chief engineer of the Canadian Pacific Railway System.

In addition to having acted as a member of the Council and vice-president of **The Institute**, Mr. Fairbairn is a director of the American Railway Engineering Association, a Member of the Institution of Civil Engineers of Great Britain,and of the American Society of Civil Engineers. His club membership includes the University Clubs of Montreal and Toronto,the Royal Canadian Yatch Club, the Kanawaki Golf Club and the Hermitage Country Club at Lake Memphremagog.

In eighteen hundred and ninety-eight Mr. Fairbairn married Hannah Louise Macfarlane, daughter of the late Thomas Macfarlane, F.R.S.C., for many years chief analyst of the Department of Inland Revenue of Canada. His family includes one son and three daughters. The former, who bears the name of his father, is at present attending McGill University, in first year Science. Mr. Fairbairn is devoted to his home and family, and his home life is known to be ideal.

President Fairbairn is able; he is popular; he is a hard worker, and possesses a great store of energy; he is yet young, and although he has already been marked as a shining light in the engineering profession, it is safe to predict that there are many more and greater honours in store for him in the years to come.

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VOL. IV. February 1921 No. 2

Professional Papers

The professional papers appearing in this issue commencing with page eighty-seven were published in advance of the meeting at Toronto and appear as advance proofs. They are, in reality Institute papers and as such are herewith presented to the members of The Institute, subject, however to author's corrections, for permanent record.

The Editor.

Report of Thirty-Fifth Annual Meeting

The Annual General Meeting and General Professional Meeting were held in Toronto, on February 1st, 2nd and 3rd at the King Edward Hotel. The President, R. A. Ross, M.E.I.C., opened the adjourned meeting, and called upon the Hon. Mr. Mills, Minister of Mines, of Ontario, who was present to extend a welcome to the members of *The Institute* to the Province on behalf of the Provincial Government. Mr. Mills expressed his appreciation of the work being done by members of the profession and promised his support to legislation proposed on behalf of engineers.

Reading of Minutes

The Minutes of the meeting held in Montreal on January 25th, were read by the Secretary, and on motion by R. O. Wynne-Roberts, M.E.I.C., seconded by G. T. Clark, A.M.E.I.C., were adopted as follows:

> "The meeting was called to order at eleven A.M., at the headquarters of *The Institute,* 176 Mansfield Street; President, R. A. Ross, M.E.I.C., in the chair.
>
> *Reading of Minutes.*
>
> It was moved by Frederick B. Brown, M.E.I.C., seconded by J. M. R. Fairbairn, M.E.I.C., and carried, that the minutes of the Thirty-Fourth Annual Meeting as published in *The Journal* of March, Nineteen Hundred and Twenty, be taken as read and approved.
>
> *Appointment of Scrutineers.*
>
> It was moved by Sir Alex. Bertram, M.E.I.C., seconded by James Ewing, M.E.I.C., that Messrs. John Farmer, M.E.I.C., and Frank Peden, A.M.E.I.C., be appointed scrutineers to report the result of the officers' ballot to the Secretary. Motion carried.
>
> *Appointment of Auditors.*
>
> It was moved by F. A. Combe, M.E.I.C., seconded by W. D. Lawrence, A.M.E.I.C., that Messrs. Riddell, Stead, Graham and Hutchison be the auditors of *The Institute* for the ensuing year. Motion carried.
>
> *Motion to Adjourn.*
>
> It was moved by C. T. DeLamere, M.E.I.C., seconded by P. B. Motley, M.E.I.C., that the meeting adjourn to resume the business of the annual meeting at the King Edward Hotel, Toronto, on February first, at ten A.M. Motion carried."

Report of Council

The Report of Council as published in the February *Journal* pages 57 to 59, on motion by Lt.-Col. Duncan Macpherson, M.E.I.C., seconded by H. B. R. Craig, M.E.I.C., were adopted.

Reports of Committees

Finance Committee.

The Report of the Finance Committee as published in the February *Journal*, pages 59 to 61, showing a surplus of $6100 on the year's operations, on motion by W. A. Bucke, A.M.E.I.C., seconded by Geoffrey Stead, M.E.I.C., was adopted.

By-Laws Committee.

The Committee recommends the following changes in the By-Laws of *The Institute.*

Sec. 3. Amend the last sentence to read:—

> "A Non-Corporate Member shall not be entitled to vote on Institute affairs, or to hold office as an Officer of *The Institute*, or as Chairman, or Vice-Chairman, of a Branch. He may be entitled to vote on Branch affairs or hold office in a Branch, other than specified as above, when so permitted by the By-Laws of the Branch."

On motion of George A. McCarthy, M.E.I.C., seconded by J. DeGaspé Beaubien, A.M.E.I.C., Sec. 3 amendment was adopted.

Section 9. Amend 2nd and 3rd last words of paragraph 1 to read, "thirty-three". The last sentence of paragraph to read:—

> "He shall not remain in the class of Junior after he has attained the age of thirty-three years."

On motion of Willis Chipman, A.M.E.I.C., seconded by J. B. Challies, M.E.I.C., Sec. 9 amendment was adopted.

Section 10. Amend 2nd and 3rd last words to read "twenty-seven". The last sentence to read:—

"He shall not remain in the class of Student after he has attained the age of twenty-seven years."

On motion of G. T. Clark, A.M.E.I.C., seconded by James Mills, A.M.E.I., Sec. 10 amendment was adopted.

Section 12. Amend by the addition of the word "three" after "thirty", the clause to read:—

"The officers of *The Institute* shall be a President, four Vice-presidents, and thirty-three Councillors."

On motion of John Henderson, A.M.E.I.C., seconded by H. K. Dutcher, M.E.I.C., Sec. 12 amendment was adopted.

Section 13. Amend by substituting "eleven" for "ten", third line, paragraph to read:—

"The term of office of the President shall be one year; of the vice-presidents two years; and of the Councillors three years. Two vice-presidents and eleven councillors, in addition to any required to fill vacancies shall be filled annually."

On motion of R. F. Uniacke, M.E.I.C., seconded by R. O. Wynne-Roberts, M.E.I.C., Sec. 13 amendment was adopted.

Section 32. Expulsion and Discipline. Sec. 32, last paragraph, to be changed to read as follows:—

"In case the Council on receiving a complaint in writing, shall be of the opinion that the conduct of any Corporate or Non-Corporate Member should become the subject of enquiry with the view to ascertaining whether there are grounds for disciplining or expelling him; or in case twenty or more Corporate Members shall think fit to draw up and sign a request for such an inquiry regarding any Corporate or Non-Corporate Member on any ground whatever, and shall deliver the same to the Secretary to be laid before Council for consideration; the Council shall first notify, by registered mail, the member against whom the complaint is laid, setting forth the charges and by whom made, and naming a date not less than six weeks from the date of such notification, for the holding of an enquiry."

"If the defendant member decides that he desires to be present in person at the enquiry, and so advises Council in writing, or by telegram, sent to the Secretary within four weeks from date of mailing the notification from Council, the Council shall rename a day for the enquiry, not less than eight weeks from date of preliminary notification, and shall notify complainants and defendants by registered mail at least four weeks previous to new date set and shall request their presence. Should any complainant member, after receiving due notice, fail to appear at the enquiry, without having previously given reasons in writing or by telegram satisfactory, to Council, the Council shall demand of such deliquent member in writing by registered mail, that he furnish the defendant member, through Council, a written apology satisfactory to Council, or send in his resignation from *The Institute;* failing doing so, the Council shall cause the name of such deliquent member to be erased from the register and thus expel him."

"On the final date set for an enquiry, the Council shall make such inquiry as they deem adequate, the complainant and defendant members, if present, being given full opportunity for deposition and examination. Should Council not find sufficient reasons for disciplining or expelling the said member, no record of the enquiry shall be made in the Minutes; but, if Council, by a majority of four-fifths of those present at a meeting especially summoned for the purpose, and at which at least twelve members of the Council are present, does find good reason for expelling or otherwise disciplining the said member on the ground that he has been guilty or improper conduct, the Council shall cause the name of such person to be erased from the Register, and thus expel him from *The Institute;* or otherwise discipline him at their discretion. The Secretary shall forthwith notify the Members of the decision of the Council and should the member be expelled the Council shall report such expulsion at the next Annual General Meeting."

"Should the complainant or defendant be a member of Council he shall not act as a Councillor in any matter affecting the inquiry."

"No verbal or anonymous complaint against any Corporate or Non-Corporate Member shall be considered or acted upon by Council."

On motion of A. H. Harkness, M.E.I.C., seconded by W. A. Bucke, A.M.E.I.C., Section 32 amendment was adopted.

Section 34. "Annual Fees." Amend Sec. 34 to read as follows:—

"The annual fees payable by Residents shall be as follows:—

Members	$18.00
Associate Members	15.00
Juniors	10.00
Students	2.00
Associates	18.00

The annual fees payable by Branch Residents shall be as follows:—

Members	$15.00
Associate Members	13.00
Juniors	8.00
Students	2.00
Associates	18.00

The annual fees payable by Non-Residents shall be as follows:—

Members	$13.00
Associate Members	11.00
Juniors	6.00
Students	2.00
Associates	18.00

Honorary Members shall be exempt from annual fees."

It was moved by Lt.-Col. Duncan MacPherson, M.E.I.C., seconded by J. E. A. Warner, A.M.E.I.C., that Sec. 34 amendment be adopted.

It was moved in amendment by W. A. Bucke, A.M.E.I.C., seconded by J. B. Challies, M.E.I.C., that this meeting do not approve of the amendments set out in Sec. 34. The amendment carried.

Library and House Committee.

On motion by R. O. Wynne-Roberts, M.E.I.C., seconded by James Milne, M.E.I.C., the Report as published in February *Journal*, page 63, was adopted.

Canadian National Committee of the Electro-Technical Commission.

On motion by J. De Gaspé Beaubien, A.M.E.I.C., seconded by S. Blumenthal, A.M.E.I.C., the Report of this Committee as published in the February *Journal*, page 63, was adopted.

Papers Committee.

On motion by E. N. Martin, A.M.E.I.C., seconded by A. H. Harkness, M.E.I.C., the Report of this Committee as published in the February *Journal*, page 64, was adopted.

Committee on Policy.

On motion by J. B. Challies, M.E.I.C., seconded by Willis Chipman, M.E.I.C., the progress Report of the Committee on Policy as published on pages 65 and 66 of the February *Journal* was received.

Publications Committee.

On motion by Geoffrey Stead, A.M.E.I.C., seconded by H. S. Van Scoyoc, A.M.E.I.C., the Report of this Committee published on page 66 of the February *Journal* was adopted.

Committee of International Relations.

On behalf of the Chairman of this Committee, H. H. Vaughan, M.E.I.C., the Secretary announced that definite results had been achieved by this Committee, and that arrangements had been completed with the American Society of Mechanical Engineers for an indefinite term and with the American Institute of Mining and Metallurgical Engineers for one year whereby these Societies had graciously agreed to provide their publications to members of *The Engineering Institute* at the same rates as are being paid by members of the Societies themselves. This Report was received with considerable satisfaction, and on motion by the Secretary, seconded by C. H. Keefer, M.E.I.C., the Report was adopted.

Uniform Steam Boiler Specifications.

On motion by James Milne, M.E.I.C., seconded by L. W. Gill, M.E.I.C., the Report was adopted.

Leonard Medal.

Your Committee appointed to judge the papers eligible for competition for the Leonard Medal for the year 1919 awarded the medal to E. E. Campbell for his paper on "Hidden Creek and its Operation" presented to the Canadian Mining Institute. Signed by H. E. T. Haultain, John Bonsall Porter and H. H. Vaughan.

Your Committee appointed to judge the papers eligible for competition for the Leonard medal for the year 1920 awarded the medal to J. C. Nichol and Staff for their paper on the "Mining and Smelting Operations of the International Nickel Company of Canada" presented to the Canadian Mining Institute. Signed by H. E. T. Haultain, J. B. Porter and H. H. Vaughan.

Plummer Medal

Your Committee appointed to judge the papers eligible for competition for the Plummer medal do not consider that any paper presented during the past year merits the award of this medal but in view of it not having been awarded last year, recommend that it be presented to A. Stansfield, M.E.I.C., for his paper on "Electrical Furnaces" presented to *The Engineering Institute of Canada.*

Gzowski Medal.

Your Committee appointed to judge the papers eligible for competition for the Gzowski medal awarded the medal to R. deL. French, M.E.I.C., for his paper on "Design and Construction of Reinforced Concrete Covered Reservoirs" presented to *The Engineering Institute of Canada.* Signed by H. H. Vaughan, Acting Committee.

Students' Prize.

Your Committee appointed to judge the papers eligible for competition for the Student's Prize awarded the medal to John R. Dunbar, S.E.I.C., for his paper on "Primary Triangulation of the Geodetic Survey of Canada" and desire to express their appreciation of the high degree of merit possessed by this paper. Signed by H. H. Vaughan, Acting Committee.

Prize Report.

On motion by John Henderson, A.M.E.I.C., seconded by G. A. McCarthy, M.E.I.C., the Report of the Prize Committee was adopted.

Reports of Branches

Victoria Branch. On motion by D. O. Lewis, M.E.I.C., seconded by H. K. Dutcher, M.E.I.C., the Report of the Victoria Branch (February *Journal,* page sixty-seven) was adopted.

Vancouver Branch. On motion by H. K. Dutcher, M.E.I.C., seconded by L. L. Brown, M.E.I.C., the Report of the Vancouver Branch (February *Journal,* page sixty-eight) was adopted.

Calgary Branch. On motion by Col. J. S. Dennis, M.E.I.C., seconded by A.B. Lambe, A.M.E.I.C., the Report of the Calgary Branch (February *Journal,* page sixty-eight) was adopted.

Edmonton Branch. On motion by John Henderson, A.M.E.I.C., seconded by Mr. Learmonth, the Report of the Edmonton Branch (February *Journal,* page seventy) was adopted.

Saskatchewan Branch. On motion by D. A. R. McCannell, A.M.E.I.C., seconded by A. N. Ball, A.M.E.I.C., the Report of the Edmonton Branch (February *Journal* page seventy) was adopted.

Winnipeg Branch. On motion by H. D. H. Scott, A.M.E.I.C., seconded H. P. Heywood, A.M.E.I.C., the Report of the Winnipeg Branch (February *Journal,* page seventy-one) was adopted.

Sault Ste. Marie Branch. On motion by Alex. MacPhail, M.E.I.C., seconded by L. M. Jones, M.E.I.C., the Report of the Sault Ste. Marie Branch (February *Journal,* page seventy-two) was adopted.

Niagara Peninsula Branch. On motion by H. L. Bucke, M.E.I.C., seconded by F. W. Clark, A.M.E.I.C., the Report of the Niagara Peninsula Branch (February *Journal,* page seventy-four) was adopted.

Hamilton Branch. On motion by A. R. Hannaford, A.M.E.I.C., seconded by E. Blake Allan, A.M.E.I.C., the Report of the Hamilton Branch (February *Journal,* page seventy-four) was adopted.

Toronto Branch. On motion by R. O. Wynne-Roberts, M.E.I.C., seconded by G. T. Clark, A.M.E.I.C., the Report of the Toronto Branch (February *Journal,* page seventy-six) was adopted.

Peterborough Branch. On motion by R. L. Dobbin, M.E.I.C., seconded by R. B. Rogers, M.E.I.C., the Report of the Peterborough Branch (February *Journal,* page seventy-seven) was adopted.

Kingston Branch. On motion by H. B. R. Craig, M.E.I.C., seconded by L. W. Gill, M.E.I.C., the Report of the Kingston Branch (February *Journal,* page seventy-seven) was adopted.

Ottawa Branch. On motion by G. B. Dodge, M.E.I.C., seconded by Lt.-Col. Duncan MacPherson, M.E.I.C., the Report of the Ottawa Branch (February *Journal,* page seventy-eight) was adopted.

Montreal Branch. On motion by J. DeGaspé Beaubien, A.M.E.I.C., seconded by H. S. Van Scoyoc, A.M.E.I.C., the Report of the Montreal Branch (February *Journal,* page eighty-one) was adopted.

Quebec Branch. On motion by J. E. Gibault, A.M.E.I.C., seconded by S. Blumenthal, A.M.E.I.C., the Report of the Quebec Branch (February *Journal,* page eighty-four) was adopted.

St. John Branch. On motion by S. C. Webb, A.M.E.I.C., seconded by G. Stead, A.M.E.I.C., the Report of the St. John Branch (February *Journal,* page eighty-four) was adopted.

Moncton Branch. On motion by S. B. Wass, A.M.E.I.C., seconded by F. B. Fripp, A.M.E.I.C., the Report of the Moncton Branch (February *Journal,* page eighty-five) was adopted.

Halifax Branch. On motion by Mr. Stewart, seconded by G. B. Dodge, M.E.I.C., the Report of the Halifax Branch (February *Journal*, page eighty-five) was adopted.

Ontario Provincial Division. The Report of the Ontario Provincial Division was presented by A. B. Lambe, A.M.E.I.C., as follows:—

Pursuant to the direction of By-Law No. 63, the undersigned take pleasure in submitting the following Report as the activities of that Division for the calendar year 1920, namely,—

1. The membership of the Division consists according to *The Institute* By-Laws of all the members of *The Institute* resident in Ontario. The Executive Committee consists of the nine Ontario Councillors and those honorary Councillors, two in number, resident in Ontario, (ex-officio); eight Branch Representatives, (appointed); six representatives of the non-resident Corporate Members, (elected); and the past Chairman and Secretary-treasurer of the Division, (both ex-officio). Each month's issue of *The Journal* contains the detailed personnel of the complete Committee.

2. The Executive Committee has held five meetings during the year, average attendance 10. As the Committee membership has averaged 25 during the year, this works out to an attendance factor of 40%, which is remarkably good, especially when one remembers the large territory represented and the consequent extended travelling entailed by even the most central meeting point.

3. In addition to the above meeting a large amount of business has been transacted by means of correspondence.

4. One of the most important activities with which the Division Executive has been concerned during the year is that of Professional Engineering Legislation in the Province of Ontario. As Council is aware, there was formed late in 1919 what is known as the Advisory Conference Committee, consisting of two representatives from each of the seven professional engineering bodies in Ontario, namely,

American Institute of Electrical Engineers, Toronto Section.
American Society of Mechanical Engineers, Ontario Section.
Association of Ontario Land Surveyors.
Canadian Institute of Mining and Metallurgy.
Canadian Society of Chemical Industry.
Engineering Institute of Canada, Ont. Prov. Div.
Ontario Association of Architects.

this Committee being charged with the heavy responsibility of preparing a Professional Engineering Bill. After approximately twelve month's work the Committee has just submitted a draft Act, which draft we take pleasure in stating has been approved by all the eight Branches of *The Institute* in Ontario, and this with but few suggestions as to changes. Besides this our Branches have also very strongly endorsed the proposal to have the Bill presented to the forthcoming session of the Ontario Legislature, if the other constituent bodies also agree the Bill will accordingly be introduced, and it is sincerely hoped will be passed.

5. In this connection we desire to emphasize that the Advisory Conference Committee has not only proved an exceptionally good method of getting together the different technical bodies in Ontario in connection with the specific question for which it was organized, but has also undoubtedly proved a means of promoting an acquaintanceship and good understanding between them that could not be obtained in any other way. We think we voice the opinions of all our members in commending the principle as a very happy method of considering and settling any common technical proposition or problem.

6. Another very important matter to the Division and all its members was the Professional Meeting organized and conducted by the Niagara Branch in September last. The work connected therewith was very great, and the financial responsibilities were large, 99% of both was assumed by the members of the Niagara Peninsula Branch. All the more credit is due them when it is remembered that their membership is of necessity not nearly as large as some of the older Branches.

7. The Division has from time to time brought forward the question of the remuneration of engineers, suggesting that it be empowered to prepare and issue a salary schedule for Ontario. However, Council decided, and doubtless quite properly so, that it would be better that any such schedule should be prepared and issued by *The Institute* at large, and that it should cover Canada from coast to coast. Consequently the Council Committee on Remuneration was appointed, its report, and action thereon, is of course anxiously awaited by all members.

8. In the meantime it should be noted as a matter of congratulation to all concerned that a draft salary schedule prepared by the Niagara Peninsula Branch has been adopted as a standard for all work on the Queenston-Chippawa development of the Hydro-Electric Power Commission of Ontario.

9. During the year there has been inaugurated the plan of giving a rebate to any Branch in connection with any *Journal* advertising which it may be successful in securing. The arrangement, which appears to be one that should be very satisfactory to all concerned, is we understand the outcome of a joint suggestion of the general secretary and our Niagara Peninsula Branch.

10. Another matter that the Division has had in hand during the year, on the initiative of the Toronto Branch, has been the discussing with the Ontario Government the appointment of engineers to those positions obviously requiring incumbents with professional engineering experience. The Toronto Branch have very kindly undertaken to maintain a Committee charged with the duty of handling such matters with the Ontario Government, so far it is functioning very satisfactorily and the thanks of all Ontario members are due to Toronto for its trouble in the matter.

11. The question of Division finances has been a very serious problem during the current year, first because the Executive was most desirous of aiding the Niagara Branch in the financing of the September Professional Meeting, secondly because considerable expenditures have had to be met in connection with Engineering Legislation, and much larger ones will face us next year. We sent out a circular to our members in June of this year, inviting subscriptions, to which the response was quite universal, the total receiving running to about $575.00. A great deal more however will be needed next year, in view of which and in view of Council's proposal that the membership fees be raised, we have made the suggestion to Council that a rebate of 50¢ per Ontario Corporate Member be made to the Division during 1921. Besides this we have asked Council to provide some machinery for the regular financing of Provincial Divisions: it is sincerely trusted that that body will shortly see its way clear towards making some permanent arrangement that will be mutually satisfactory to all concerned.

12. Another exceedingly important matter now before Council on our recommendation is the suggestion that the By-Laws of *The Institute* be changed so as to provide that every Branch be directly represented on Council. Under the present arrangement the Branches in any given district have all to vote on the same Council vacancy, obviously where the membership of one Branch far outnumbers that of its fellows that nominee who is a member of the larger Branch will invariably be elected. In other words,

under the present By-Laws the smaller Branches stand but little change of ever electing one of their members to Council, a condition that is not satisfactory to either of the pairs of Branches that may be particularly concerned, besides being obviously one that militates against the best working and advancement of *The Institute* as a whole. Our Executive considers that the question involves a most important principle and therefore trusts that it will not be long before the By-Laws are changed so as to meet the situation satisfactorily.

13. Another matter is that of the place of Council meetings. The Division Executive feels rather strongly that it will be to the great good of not only the membership in Ontario, but to that of *The Institute* at large, if Council could see its way clear to inaugurating the policy of having Council meetings at regular intervals at some point other than Headquarters. As a starter we have suggested that they meet at least once a year at some suitable point in Ontario, and sincerely trust that it will be found possible to agree to our proposal.

14. Lastly, but in some ways the most important questions of all, are the various matters considered at the Montreal Conference called by Council in April last, to which were invited the members of the Ontario Executive and Ontario Branch Officers. The outcome was the appointment by Council of a Committee on Policy, which Committee has in its hands the reporting upon such exceedingly important questions as *The Institute's* lines of action concerning technical activities; internal relationships and local associations; student, (under-graduate) membership; relations with other national societies and related organizations; the suggested re-arrangement of the membership grading; the changing of the By-Laws covering the rights and privileges of juniors; combination membership in the E.I.C. and one or more other Canadian or U. S. professional engineering organizations; etc., etc. In due course Council will undoubtedly receive a report from the above Committee which will without question furnish a great deal of food for thought, and contain suggestions and plans of action that if followed will go far towards settling the foregoing most important questions, this in turn redounding to the great good of both the individual member and *The Institute* at large.

Respectfully submitted,

H. B. R. CRAIG, *Chairman.*
W. H. MAGWOOD, *Vice-Chairman.*
A. B. LAMBE, *Secretary.*

On motion by A. B. Lambe, A.M.E.I.C., seconded by H. B. R. Craig, M.E.I.C., the Report was adopted.

Nominating Committee.

The following comprises the Nominating Committee for the year 1921, being the nominees of the various Branches: Niagara Peninsula, H. L. Bucke, M.E.I.C.; Halifax, W. P. Morrison, M.E.I.C.; Sault Ste. Marie, B. E. Barnhill, M.E.I.C.; Kingston, Alexander MacPhail, M.E.I.C.; Border Cities, A. E. Eastman, A.M.E.I.C.; Winnipeg. J. G. LeGrand, M.E.I.C.; Saskatchewan, L. A. Thornton, A.M.E.I.C.; Vancouver, H. E. C. Carry, M.E.I.C.; Moncton, E. G. Evans, M.E.I.C.; Edmonton, R. J. Gibb, M.E.I.C.; Montreal, H. M. Mackay, M.E.I.C.; and A. E. Doucet, M.E.I.C.; Quebec, L. C. Dupuis, A.M.E.I.C.; Calgary, F. W. Alexander, M.E.I.C.; Toronto, George T. Clark, A.M.E.I.C.; St. John, F. G. Goodspeed, M.E.I.C.; Victoria, E. F. Cooke, A.M.E.I.C.; Hamilton, E. H. Darling, M.E.I.C.; Ottawa, John Murphy, M.E.I.C.; Peterborough, Jas. Mackintosh, A.M.E.I.C.

Canadian Engineering Standards

Report received.

Committee on Classification and Remuneration.

There was no official Report for this Committee, the Chairman calling upon the Chairman of the Committee, A. H. Harkness, A.M.E.I.C., to give an outline of the situation. Mr. Harkness gave a review of the work of this Committee stating that the final Report of the Council had been withheld at the request of the Ontario Provincial Division, and that all Branches of *The Institute* had been notified.

Officers elected.

The report of the Scrutineers as read by the Secretary giving the result of the ballot showed that the following officers and Members of Council had been elected.

President, J. M. R. Fairbairn, M.E.I.C.;
Vice-President, H. G. Acres, M.E.I.C.;
Walter J. Francis, M.E.I.C.

Councillors:—District No. 1, F. P. Shearwood, M.E.I.C., K. B. Thornton, M.E.I.C.; District No. 2, S. S. Oliver, A.M.E.I.C.; District No. 3, C. C. Kirby, M.E.I.C.; District No. 4, G. B. Dodge, M.E.I.C.; District No. 5 (three-year term), C. R. Young, M.E.I.C., (two-year term), R. L. Dobbin, M.E.I.C.; District No. 6, A. C. D. Blanchard, M.E.I.C., (one-year term), H. B. R. Craig, M.E.I.C.; District No. 7, W. M. Scott, M.E.I.C.; District No. 8, H. S. Carpenter, A.M.E.I.C.; District No. 9, S. G. Porter, M.E.I.C.; District No. 10, H. L. Johnston, M.E.I.C.

On motion by R. O. Wynne-Roberts, M.E.I.C., seconded by John Henderson, A.M.E.I.C., the report was adopted.

New Business.

A cordial invitation to hold the 1922 Annual Meeting at Winnipeg was received from Ed. Parnell, Mayor of Winnipeg, and from the Winnipeg Board of Trade. An invitation was also received from the Chairman of the Vancouver Branch requesting that the next Annual Meeting be held at Vancouver. These invitations were referred to the Council for action, and the Secretary was instructed to extend the thanks of *The Institute* to the Mayor and Board of Trade of Winnipeg and to the Vancouver Branch, for their kind invitation.

A letter of felicitation was presented from the Secretary of the Association of Canadian Building and Construction Industries. A telegram from Vice-President Walter J. Francis, M.E.I.C., was read in which he conveyed regrets at being unable to be present, and extended congratulations to the retiring President and the newly elected President. Similar messages were received from George A. Mountain, M.E.I.C., and G. G. Murdoch, M.E.I.C. A telegram conveying a Resolution of the Pulp and Paper Association urging *The Institute* to use its influence with the Government towards the establishment of a national research institute was referred to the Council for action.

A lengthy discussion took place on the suggestion of the Ontario Provincial Division that the membership grades of *The Institute* be altered. The Chairman of the Committee on Policy was instructed to make a note of the discussion as an expression of the opinion of the various members for consideration in connection with his Report to Council.

The business of the meeting being concluded President R. A. Ross, M.E.I.C., delivered his retiring Presidential Address, following which he inaugurated the new President, J. M. R. Fairbairn, M.E.I.C.

President Fairbairn thanked the members of *The Institute* for the honour conferred upon him and then brought the business portion of the meeting to a conclusion.

Annual Banquet, King Edward Hotel

Wednesday Evening, February 2nd.

At the banquet held under the auspices of *The Engineering Institute of Canada*, J. M. R. Fairbairn, M.E.I.C., chief engineer of the C.P.R., and the newly elected president of *The Institute*, presided, the guest of honor being E. W. Beatty, president of the C.P.R.

The president, Mr. Fairbairn, in proposing the toast to "Our Guest," said that railways are often spoken of as the arteries of a country, those veins through which the streams of commerce flow throughout the land, carrying raw materials to manufacturing districts and distributing finished products to the farthest centres of population. They have, however, another most important function as well, in that they make possible freedom of intercourse between peoples in various parts of any country, encouraging and fostering a knowledge and understanding of one another, which, without railway communication, would be an impossibility. It has been part of our business as engineers to explore for, locate, construct and finally maintain the railways of our native land, and in this way we have some claim to consider ourselves as the pathfinders of commerce, modern civilization and that political unity which has united the component parts of this great Dominion from Atlantic to the Pacific.

Following the engineers who construct a railway and its equipment come the men who maintain and operate it, those who sell its one great, and valuable, product, transportation, as well as those who collect its funds, pay its debts, purchase its supplies, keep its accounts, and a host of others, all of whom serve the one great organization which, though divided into so many departments, having so many and varied duties, has, on the other hand, heads to all those departments, and over these executive officers directing whole groups of departments, subsidiary lines, steamers, telegraph, express service and the like. These again are responsible to vice-presidents, whose various functions, no matter how important, ultimately culminate in the one directing head of every railway, the president, the man who carries responsibility for the whole enterprise, and who forms the one connecting link between the owners and their property.

E. W. Beatty, in responding spoke in part as follows:

"Whatever the cause, the corporate opportunities for engineers are greater to-day than ever, and in no place as great as the great railway systems, one of the largest in the world being, I understand, almost, entirely officered by graduates in engineering.

"The debt of gratitude which big Canadian systems owe to the engineering profession is difficult to estimate accurately. The fact is that the Canadian Pacific would never have pierced the mountains without the assistance of engineers of the highest skill, and none of the larger facilities which have since been provided would have been possible had not your profession numbered among its membership men of conspicuous ability and even genius.

"In order to ensure the proper development of territory tributary to the company's lines, irrigation works of great magnitude were taken adjacent to Calgary and Lethbridge. The construction of these systems involved the completion of over 5 000 miles of canals and ditches, serving a total area of approximately 750,000 acres of irrigable land, and represented in construction and maintenance an expenditure of over $15,000,000.

"The completion of these systems has converted what was otherwise a semi-arid district into one of the most highly developed and permanent crop-producing areas of the Dominion.

"Some years ago, in order to reduce curvature and grades and eliminate four and one-half miles of expensive snowsheds, it became necessary to penetrate the Selkirks under Mount Macdonald, 85 miles west of Field, at a point about 5,000 feet below the peak. The work was carried on under the supervision of Canadian engineers with an exactitude that speaks highly of their skill. The tunnel is five miles in length, 29 feet wide, with maximum height of 24 feet. The method of construction was interesting and unique. The work was started in 1914 and the completed tunnel put in operation in 1916, the total time of construction being two and a half years, and the total cost $6,500,000.

"I might mention two almost equally interesting but different types of construction which were undertaken by Canadian engineers for the company. The rebuilding of the St. Lawrence bridge in 1911, having a length of 3,657 feet and two main spans over the navigable channel of 410 feet long, and 60 feet above the water level.

"An interesting undertaking was the construction of the Lethbridge viaduct, a steel trestle of 67 spans on steel towers and concrete substructure. Its length is slightly over a mile, and height over two-thirds of its length 300 feet The weight of the steel used in its construction was 12,000 tons, and the cost approximately one million and a half.

"Each one of these works was immensely important, difficult to carry out, involving new methods of construction, and in each case undertaken and carried to a successful completion by Canadian engineers.

"These are only instances of the variety of progress made by engineers, but are indicative of the tremendous progress made in the profession, and the ability to meet and surmount difficulties which in earlier years might easily have been regarded as almost insurmountable.

"So much for the past, the history of which is much more familiar to you than to me. But what of the future?

"The problems which Canada has to face in the immediate future are problems the solution of which the engineer must play an important part.

"I could dilate at some length upon the railway situation in this country, but I am afraid this is not the time or the place to do so. If I were speaking to financial, instead of civil engineers, it might be appropriate to direct their attention to some phases of it which will require grave consideration, but these matters of general policy can only be determined in the light of our own experiences, and a portion of that experience we are now gaining.

"With an increased population and a resumption of our previous prosperity under normal conditions, the solution of our transportation difficulties may become more definitely appreciated, but in the meantime there are two things which I may say with propriety, and the first is that this trained intelligence of engineers will always be a factor in the solving of this most difficult question, and the second is that at the present time, both here and in the United States, railway companies no matter what the complexion of their stockholders may be, are making great endeavours to capitalize public opinion in their favour. I do not know of any period in our history when these efforts were as great or more likely to meet with a measure of success.

"The one supreme obligation of railway officers and executives to-day is to convince the public that what ever is humanly possible to be done to bring these costs down is being done by the companies. In other words, costs which affect rates are only going to be accepted as an excuse for those rates if they are costs which cannot be reduced by any act of the companies themselves. We owe this to the people who are paying the rates, and we owe it to ourselves, because real prosperity is that which is obtained by a free movement of traffic under rates which are moderate.

"The development of this country is bound to put upon you the responsibility for the solving of many problems. The influx of population, which will be great, is bound to provoke a situation which will require the utmost wisdom in dealing with it.

"We should see to it that we are not in any danger of repeating the discreditable slum conditions prevailing in the Old World and some of the industrial centres in the South, conditions which are productive of disease and physical and moral deterioration. I should think the engineering profession could do more than any other to advise measures to deal with this problem. It means improved methods of economical house construction. It means good roads at moderate cost. It means a scientific planning of streets and parks. It means a thousand things in which the engineer must be consulted and which only the skilled engineer can solve.

"As good Canadians, we wish to make Canada a desirable place in which to live. The engineers of Canada can do much to demonstrate to the incoming immigrant that our streets are paved with health and happiness and not merely with good intentions."

Town Planning News and Comments

H. L. Seymour, A.M.E.I.C.

A Review.

The appearance of the first number of *The Journal* of the Town Planning Institute of Canada was noted in the December issue of *The Journal* of *The Engineering Institute of Canada,* and the new publication was briefly but favourably commented on.

This first number, dated October 1st, is expected to be preliminary to the issue of an illustrated periodical which the Council of the Town Planning Institute plans to have appear at intervals of from two to three months. The next number, it is understood, is to be published in January 1921.

In looking over the new journal one is, at a glance, reminded of the "Literary Digest" as it appeared in the days of the printer's strike in New York. The material has been typed and photographed, being a pleasing and excellently executed example of that form of reproduction.

The Town Planning Institute of Canada, though of recent origin, evidently intends to make itself articulate. This, apart from the consideration of the actual subject matter that may appear in the publication, would seem to be a point of primary importance to other technical organizations, many of which have existed for years without such facility for the expression of their aspirations and activities. In other words there is here a tangible proof that the Town Planning Institute now with us, intends to stay with us. What does this mean to engineers?

Between the architect, who a few years ago claimed that only to architects, and in no way to engineers and surveyors, could the high calling of town planning descend, and the engineer who with his more exact and mathematical mind claims that town planning is at least 80% engineering, there is a wide difference of opinion. But the Town Planning Institute of Canada numbers among it over 100 members, both engineers and architects,—as a matter of fact somewhat more engineers than architects.

There are no doubt engineers who feel that town planning activities might well be confined within the membership of *The Engineering Institute of Canada.* However in England there is an Institution of Civil Engineers and a Town Planning Institute, both of these institutes doing excellent work. The Town Planning Institute forms a sort of club or common meeting ground for all professional men interested in the development of the country along sociological as well as economic lines, numbering among its members, principally of course, engineers, architects, surveyors and landscape architects. Such an institute cannot be considered a rival organization, but rather supplementary to other technical organizations. One condition of membership in the Town Planning Institute, as far as engineers are concerned, is membership in *The Engineering Institute of Canada.*

The preliminary number of the Journal of the Town Planning Institute furnishes some timely town planning news as to Canada and other countries, an interesting account being given of the Inter-Allied Housing and Town Planning Conference held in London, England, in June of last year. The list of officers and members included in the issue is of particular interest to engineers, indicating a membership from coast to coast, many of whom are engineers, and including the heads of our largest universities, and other equally prominent men.

Another item of interest is the announcement that the President of the Town Planning Institute, Thomas Adams, by arrangement between the Commission of Conservation and the Universities is to lecture on town planning before several of the more prominent Canadian Universities.

Zoning.

At a recent meeting of the Toronto Branch of the *Engineering Institute of Canada* a Committee on Zoning presented their Interim Report. This took the form of a number of illustrated talks. No recommendations were made by the Committee, an endeavour being made only to present some of the information that the Committee had collected in regard to the subject of zoning. The important point to engineers was made that the engineering technical press is now giving considerable attention to the subject, some recent articles in the "Engineering News Record" being cited.

The Zoning Committee of the Toronto Branch expect to present their recommendations at a later date, and this should be of interest to those engaged in municipal work. The Committee sent out Zoning Questionnaires to every city engineer in Canada, and from the replies received it is evident that some of the city engineers are already keenly interested in zoning.

Ontario Town Planning and Housing Conference

Under the distinguished patronage of the Lieut. Governor of Ontario, the Town Planning Association of South Western Ontario, and the Town Planning and Housing Association of Toronto are, convening a two days' conference to be held in Toronto the middle of February. The various Ontario organizations interested in Town Planning are being invited to co-operate. These include the Ontario branches or associations of engineers, architects, surveyors and town planners. Prominent speakers including several engineers are to address the Conference, and an exhibition to illustrate the progress in Town Planning and Housing, particularly in Ontario, is being arranged.

One of the main objects of the Conference is to further new Town Planning legislation, which will probably come before the Provincial House this session, and this proposed legislation will be discussed.

Of local interest, particularly to engineers, will be the session devoted to the problems in planning "Greater Toronto."

A permanent Housing and Town Planning Conference, it is expected, will result from the holding of this Conference in February.

CORRESPONDENCE

Binding the Journal

Editor, *Journal:*—

It may not have occurred to some of our members that with a small amount of time, the 1920 issues of *The Journal* may be bound in a convenient volume. This form provides a means of keeping the parts that are of value and permits an ease of access not found where the issues are filed separately.

In order to do away with unnecessary bulk in the finished volume it is wise to discard the current and advertising matter. To facilitate re-binding care should be taken to preserve the original formation of *The Journal*, as far as possible.

There are several ways of arranging and indexing the issues for re-binding. In the volume under consideration, they were kept intact and were arranged in their proper sequence; January being placed first. At the beginning of each month, a sheet bearing its name was attached. A type-written index containing the articles listed under the headings of the proper months, was placed in the front of the volume.

Three holes were punched, spaced two, six, and ten inches from the bottom of the page and three-eighths of an inch from the left-hand edge. A thin strip of brass, one-half by twelve inches correspondingly punched, was placed on each side of the binding edge and the whole pressed firmly together and held in place with split-pin paper fasteners. The cover which had been previously copied on tracing-linen and printed on blueprint cloth was then glued in place on the binding. The resulting volume presents *The Journal* in a compact form that can be carried about with little trouble.

Yours very truly,

J. LeRoy Underhill, S.E.I.C.

*

Status of Juniors

January 25th, 1921.

The Editor, *Journal:*—

Dear Sir,

A number of letters have appeared in "Mechanical Engineering", from time to time, written by both Corporate Members and Juniors of the American Society of Mechanical Engineers on the topic of the status of Juniors in the Society. Most of those letters were strongly in favour of the Junior being made a Corporate Member. The grounds for such a contention were based chiefly on two points: Juniors are the coming generation of engineers and should be more closely identified with the affairs of the Society; and during the war, the junior engineers made an undying name for themselves in the profession.

How much more truly and fully does this apply to the young Canadian engineers who had thrown themselves into the stupendous task three years earlier and had acquitted themselves so creditably.

It would be extremely interesting to me to see some opinions from Corporate Members and Juniors of *The Institute* alike on this subject, where there is considerable effort being made to increase the active interest of all members and to increase the membership not only amongst engineers, but those interested in engineering by the introduction of Affiliates.

It is most natural that Students, Associates and Affiliates should not be admitted to full membership privileges as the Student as a graduate engineer is an uncertain quantity, while the latter two do not belong to the profession; but is is different with the Junior.

Yours truly,

Donald Ross-Ross, Jr.E.I.C.

Canadian Consolidated Rubber Co., Ltd.,
Planning Department.
Montreal, Que.

*

Status of Subordinate Engineers

Jan. 19th, 1921.

Editor, *Journal:*—

In reply to your letter of Jan. 15th, I can only give my personal opinion.

The question submitted by the Junior member of the profession is as follows:—

"Can you explain in *The Journal* the status of a subordinate engineer under the proposed professional Act in Ontario. In my last position I was chief draughtsman with six men—now just a cog in the wheel designing reinforced concrete."

During the last one hundred and fifty years there has been a continual tendency to replace the individual craftsman by machinery, and to standardize manufactured products. This natural tendency has now reached the profession, and the majority of the engineers employed by the Public Works Department, of the Dominion or of the Province, by the Hydro-Electric Commission, and by the Railways are now engaged on a restricted class of work. This is inevitable to secure economy in results and efficiency, but at the same time this development of system in the modern large office may smother the aspirations of the enterprising young engineer. He may by exceptional ability, or by chance, obtain promotion, or he may lose hope, and drift along, passing out superannuated, in practically the same position as when he entered the service.

The proposed legislation will undoubtedly raise the standard of the profession, even if nothing be gained but legal recognition.

I believe, however, that the Provincial Associations embracing all classes of engineers, will gradually be able to secure changes in the administration of Departments, Railways, etc., that will benefit the junior engineers.

Under Section 10 of the Ontario Bill, sufficient latitude is given the Council to determine whether an applicant be qualified for membership or not.

An attempt to protect junior engineers against competition of unqualified men, by an Act of Parliament, would, for obvious reasons, be defeated. We must trust the chief engineers, and their chief assistants, who will be members of the Association, to discourage the employment of unqualified men. Within a few years I am confident that no man will be classed as an engineer who is not a college graduate.

The good old days when the chainman and draughtsman gradually ascended the ladder of promotion to the position of chief have passed forever.

Junior engineers, "cogs in the wheel," may be qualified, or they may not, but upon the evidence submitted by the applicant, the Council must decide each individual case on its merits.

Juniors who have not the necessary qualifications for membership when the Act comes in force may file their credentials under Section 11, and at the termination of the necessary period for qualification may be admitted under Section 12 without examination, or they may be admitted by examination.

Yours sincerely,

WILLIS CHIPMAN, M.E.I.C.

EMPLOYMENT BUREAU

To make this department more valuable it is proposed that in future advertisements of situations vacant should state salary, and give details of requirements.

Situations Vacant

Mechanical Engineer

Graduated Mechanical Engineer wanted, preferably with Pulp and Paper Mill experience, for large Canadian Sulphite Mill. Please state age, and experience, and enclose copies of references. Box 186.

Engineer

Engineer required to supervise water distribution system in Montreal. Must be experienced water-works man. Box 188.

Mechanical Draftsmen

Two mechanical draftsmen for Pulp and Paper Company in Northern Ontario. Should be experienced in piping, machinery layout and have some knowledge of construction detail. Salary about $175.00 a month. Box 189.

Draftsmen

Two draftsmen for Pulp and Paper Company in Northern Ontario, at $150.00 per month. Box 190.

Large Canadian Manufacturing Company has openings in Industrial Engineering for 1919, 1920 and 1921 graduates. Successful applicants would undergo a course of intensive training for a period of six months, during which all expense would be paid. A sound knowledge of Industrial and Economical conditions is essential. Box 191.

The Civil Service Commission of Canada hereby give public notice that applications will be received from persons qualified to fill the following positions in the Civil Service of Canada:—

Patent Examiners

2047. Patent Examiners at an initial salary of $2,340 per annum, which will be increased upon recommendation for efficient service at the rate of $180 per annum, until a maximum of $3,420 has been reached. This initial salary will be supplemented by whatever bonus may be provided by law.

Duties. — To examine applications for patents of inventions in order that there may be granted, restricted, or refused the monopoly which the Patent Act provides; to determine the correctness of specifications, practicability, utility, and novelty of inventions from the technical aspect; to consider the application for patent from a legal aspect; to report on such applications to the Commissioner of Patents; to specialize in one or more of the engineering or scientific divisions of the work of the Patent Office; and to perform other related work as required.

Qualifications. — Graduation in science from a university of recognized standing with specialization in chemistry or pharmacy; knowledge of chemical processes in the field of organic chemistry; or in the field of metallurgy and inorganic chemistry; at least three years of experience as Assistant Patent Examiner or four years of experience in work of the same nature and of equivalent standard; thorough familiarity with the practical application in commercial and industrial practice of the chemical branch of patent examiners' work; thorough knowledge of the Patent Act and a general knowledge of patent procedure; ability to read and follow complicated plans and designs; quickness of perception; good judgment.

Examination. — Education, Training and Experience, 4; Oral examination, if necessary in the opinion of the Commission, 1.

There is one vacancy at present in the Examiners' Division, Patent and Copyright Office, Ottawa.

Instructor in Engineering

2048. An Instructor in Engineering at the Royal Military College, Kingston, at an initial salary of $2,340 per annum which will be increased upon recommendation for efficient service at the rate of $120 per annum until a maximum of $2,820 has been reached. This initial salary will be supplemented by the bonus provided by law.

Duties. — Under direction, to give instruction in engineering and surveying at the Royal Military College; on occasion to give individual instruction to cadets; to correct and criticize exercises; to prepare, examine, and rate examination papers; in some cases to give lectures; and to perform other related work as required.

Qualifications. — Education equivalent to graduation in engineering from a school of applied science of recognized standing; preferably at least two years of experience in engineering design or construction work; wide theoretical knowledge of the mathematical principles of engineering; ability to deal tactfully and firmly with cadets; good personality.

Examination. — Subjects and Weights as follows: — Education, Training and Experience, 3; Oral Examination, if necessary in the opinion of the Commission, 2.

General Directions

Selections for eligible lists of applicants qualified to fill similar vacancies which may occur in future may be made from the applications for these positions.

According to law, preference is given to persons who have been on active service overseas in the military or naval forces of His Majesty, or any of the Allies of His Majesty, during the late war. The age limit does not apply to persons who have seen active service overseas, but these candidates must furnish a certified copy of their discharge certificates, or in the case of commissioned officers, a certified statement of their military services.

Application forms properly filled in must be filed in the office of the Civil Service Commission not later than February 17, 1921. Application forms may be obtained from the office of the Employment Service of Canada, or from the Secretary of the Civil Service Commission, Ottawa.

By Order of the Commission,

W. Foran,
Secretary.

Ottawa, January 24, 1921.

Situations Wanted

Civil Engineer

Civil engineer A.M.E.I.C., 34. Open for engagement about March 15th. Twelve years experience covering all branches of railway work, power development, pulp and paper mill work, highway construction. Considerable executive experience. Graduate of leading University. Box 49-P.

Railway Engineer

A Corporate Member of *The Institute*, a lieutenant-colonel, at present chief engineer of an Eastern Railway, desires a position in Canada, railway or highway work preferred. Thoroughly experienced in construction. Box 50-P.

Civil Engineer

Graduate Civil Engineer, A.M.E.I.C., age 27, six years field and engineering drafting office experience seeks new engagement in any line of engineering work. Good draftsman. Well recommended. Over four years in last position. Address, Box 50-P.

Civil Engineer

Civil Engineer, A.M.E.I.C., and graduate land surveyor, with several years' experience in railroad construction and location and general engineering, surveying and draughting, is open for position. Address, Box 51-P.

Engineer

Engineer, Jr.E.I.C., age 30 — eight years experience in civil and mechanical engineering including three years experience as instrumentman — five years machine design — layout and construction of saw mills — hydraulic presses — petrol engines — clerical cable ways. Open for position at once. Salary expected, $200.00 per month. Address, Box 52-P.

Graduate Electrical Engineer

Graduate electrical engineer, A.M.E.I.C., with two years' testing experience and five years' experience in design of large electrical machinery desires a change. Would prefer position with a Pulp & Paper Industry. Box 54-P.

Students available for employment at end of University session.

Simcoe C. Scadding, S.E.I.C., 3rd yr. electrical engineering. Prefers electric railway work.

Experience: One summer surveying and one summer machine shop. Address: Engineering Building, University of Toronto.

David Burns, third year electrical power station operating desired. Address, Central Y.M.C.A., Toronto.

John G. Spotton, S.E.I.C., 3rd yr. electrical. Prefers Hydro-electric Power work.

Experience: 20 months mechanical and electrical shop work. Address: Engineering Building, University of Toronto.

Ralph M. Hawkins, S.E.I.C., 1st yr. electrical. Prefers electrical or mechanical work.

Experience: One summer electrician helper and wiring inspection. Address: Engineering Building, University of Toronto.

Wm. Thos. A. Bell, S.E.I.C., 1st yr. mechanical.

Experience: One summer installing water power machinery. Address: Engineering Building, University of Toronto,

OBITUARIES

Alfred T. Tomlinson, M.E.I.C.

Following an illness of two months, the death occurred on January 20th of Major Alfred T. Tomlinson, a prominent civil engineer, at his home in Toronto. He was born in Glen Falls, N.B., 62 years ago, and was a graduate of the Royal Military College, Kingston, served in the North-West Rebellion, and from 1915 to 1919 was attached to the Canadian Engineers, in charge of the inspection of small-arm ammunition in the Dominion Arsenal.

Following the North-West Rebellion, Major Tomlinson became actively engaged in engineering work and assumed responsible charge of railway construction work in Canada and the United States. As engineer in charge Major Tomlinson was identified with the construction of the Pike Cogs Railway, the Rio Grande; assistant engineer of the Brooklyn Elevated Railway; in charge of the litigation survey of the Brooklyn Elevated Railway; engineer in charge of the Metropolitan Subway, New York; engineer in charge of the Union Elevated and North-Western Railways, Chicago; assistant chief engineer of the Boston Elevated Railway and the construction of the Boston Subway; chief engineer of J. G. White and Co., builder of the Interurban Railway from Rochester to Lockport; the Marion and Wabash Railways, Indiana, and the Alton and East St. Louis Railway; chief engineer of the hydro-electric development of the surplus waters of the St. Lawrence at Caesar, Quebec; engineer in charge of 140 miles of the Grand Trunk Pacific, from Woodhill to Saskatoon; engineer in charge of the trunk sewer at Edmonton; district engineer of the Grand Trunk Pacific Railway, in the construction of 400 miles of railway in Western Canada, and chief engineer in charge of surveys and locations for proposed railway from Montreal to James Bay. Major Tomlinson was elected M.E.I.C., in January, 1906.

*

Thomas Fawcett, D.T.S., M.E.I.C.

Thomas Fawcett, D.T.S., M.E.I.C., died on Nov. 18th, 1920. Mr. Fawcett was born in Yorkshire, England, in 1848, and came to Canada while yet quite a young man. After studying at Albert University, Mr. Fawcett was engaged in land surveying in Manitoba, and later in Northern Ontario. During an active professional career dated from 1872, Mr. Fawcett was engaged on many important surveys, including the charge of director of surveys in the Yukon Territory, and later Survey of the Fourth Meridian and survey of the International Boundary Westward from the St. Croix River. Mr. Fawcett was elected an Associate Member of *The Institute* on July 5th, 1919. The following tribute is paid to his memory by Otto Klotz, D.T.S., L.L.D., F.R.S.C.:—

"Thomas Fawcett is no longer with us. A bleak November morning dawned and carried him across the bar. The world has lost a man, and we have lost a friend and counseller, while a home is made desolate by the absence of a good husband and kind father.

Thomas Fawcett had that rare combination of qualities — sterling integrity, indefatigable application, unsullied honor, cheerfulness, human sympathy, devoid of all ostentation, devotion to church and family — that give him an enduring place in the hearts of all who knew him or who came in contact with him.

My acquaintance goes back to the year 1877 when we both came to Ottawa to pass the newly created honorary and difficult examination of Dominion Topographical Surveyor, and our friendship has been uninterrupted these 43 years, although we have not been in close touch throughout, for our spheres lay for years in different parts of Canada.

Whatever Mr. Fawcett did, he did well, whether as assistant and serving his apprenticeship, or later as surveyor on meridians and base lines; or as explorer in the wilds of the Churchill river, or on the headwaters of the English and Albany rivers, or on International Boundary Surveys. Of powerful physique, he shared with the strongest of his men the burden of packing and portaging. It was in sharing the hardships of a surveyor's life that endeared him to all who served under him. His ever cheerfulness served as a tonic and inspiration about camp. More than one striving young man knows the material helping hand that was extended by Mr. Fawcett, whereby a career was established. If need be he would apply persuasive power in a visible manner when it meant the defence of the weak or aggression by a bully.

The days as Gold Commissioner in the Yukon were trying days for him. He gave of what was best in him in a new field. He cleared the brush, opened out a sky line and made the trail easy for his successor.

The wings of time seemed to pass over him apparently quite oblivious of his presence, or of his fleeting three score years and ten, for his youthful face had a perennial freshness, the envy as well as the joy of friends old and young. His hearty laugh was infectious, and his frank open countenance spoke of sincerity, that attribute in man that is decadent these days.

We are all the better that Thomas Fawcett lived, and his memory will abide with us as long as we tread this earth."

*

James Cron Kennedy, M.E.I.C.

James Cron Kennedy, M.E.I.C., died suddenly at Owen Sound, Ont., Jan. 1st. 1921. He was born at New Edinburgh, now part of Ottawa in 1853. and educated at Owen Sound, Ont. His first professional work was under the late T. C. Keefer, C.E., on the construction of the Ottawa Waterworks, after which he went to Toronto, under the late P. A. Peterson, C.E., on the construction of the Toronto Waterworks. Later he was town engineer at Owen Sound, Ont., and New Glasgow, N.S., then resident engineer on the construction of the Keewatin Power Co's. dam near Kenora, Ont., engineer-in-charge of the construction of waterworks and sewers at Hawkesbury, Ont., resident engineer on the construction of the Stave Lake Power Co's. hydro-electric development, near Vancouver, B.C. From 1911 until 1919 he was interested in general contracting about Vancouver, B.C. and Montreal. In 1919 he moved to Owen Sound and had general charge of construction and maintenance work for Wm. Kennedy & Sons, until his death.

Mr. Kennedy was elected a Member of the Canadian Society of Civil Engineers on February 14th, 1893.

PERSONALS

F. E. Emery, A.M.E.I.C., has been appointed Alberta representative of The Manitoba Bridge & Iron Works Ltd.

*

F. S. Rutherford, A.M.E.I.C., is now with the Technical Branch, Department of Education, Toronto.

*

C. D. Norton, A.M.E.I.C., has accepted a position with the Riordon Company, Limited, at Mattawa, Ont.

*

G. C. Bennett, S.E.I.C., formerly of Toronto is now resident in Sault Ste. Marie, Ont.

*

D. J. Ludgate, S.E.I.C., is now with the Schroeder Mills & Timber Company, Pakesley Station, Ont.

*

A. D. Murray, A.M.E.I.C., has opened an office in Montreal with a view to co-operation with consulting engineers in connection with special draughting, etc.

*

Thos. C. Jepson, A.M.E.I.C., sailed recently for England, and expects to be away from Canada for several months.

*

John Murphy, M.E.I.C., delivered an address on January 25th to the Saint John Branch on "Ice formation and Prevention".

*

F. I. Ker, A.M.E.I.C., has resigned from the superintendency of the Whelan Pulp and Paper Co. plant at Port Alice, B.C.

*

R. S. Stronach, A.M.E.I.C., has been appointed superintendent of the Rocky Mountains Park, Banff, Alberta.

*

Hew M. Scott, M.E.I.C., has accepted a position with Peter Lyall & Sons Construction Co. Ltd., in connection with work on the Esquimault Dry Dock, Victoria, B.C.

*

J. M. Wardle, A.M.E.I.C., formerly superintendent of the Rocky Mountains Park, Banff, Alta., has been appointed chief engineer, Dominion Parks Branch, Ottawa.

*

N. E. D. Sheppard, A.M.E.I.C., has resigned his position in the Dominion Water Power Branch to accept an important position with the Riordon Pulp & Paper Co., at Hawkesbury.

H. C. Craig, A.M.E.I.C., formerly of the Royal Air Force and late of the Department of Railways and Canals, is now with the Air Board, Ottawa, having been appointed to the position of director of equipment.

*

S. G. Tackaberry, A.M.E.I.C., formerly of the Royal Air Force and late of the Public Works Department, Ottawa, was recently appointed to the position of assistant director of equipment under the Air Board, Ottawa.

*

F. C. Higgins, A.M.E.I.C., formerly of the Canadian Artillery and Royal Air Force, was appointed early in 1920 to the position of Aeronautical Intelligence Officer under the Air Board, Ottawa.

*

E. L. Miles, M.E.I.C., formerly assistant to E. A. James, M.E.I.C., chief engineer of the Toronto and York Roads Commission has been appointed Superintendent of Roads for the County of Victoria, Ont., with headquarters at Lindsay, Ont.

*

Eben N. Harvie, A.M.E.I.C., has resigned from the Imperial Ministry of Munitions and has accepted a position as agent of Henry Boot & Sons, on a housing scheme in Worcester, England. Mr. Harvie expects to be engaged in the work for the next two years.

*

L. E. Wilson, M.E.I.C., now studying for his degree at Cambridge, has been awarded the prize for a lecture given recently on "Apartment Houses in Canada". He is the first undergraduate to give such a lecture, the honour usually being kept for professors and professional men high in their career.

*

J. A. Wilson, A.M.E.I.C., formerly Assistant Deputy Minister of the Naval Department, Ottawa, was appointed early in 1920 to the Air Board as General Secretary. This Department although one of the newest of the Government's Departments at Ottawa is by no means the least active, and has just completed a most successful year's work.

*

Captain P. Charton, Croix de Guerre, A.M.E.I.C., has returned to Montreal after serving six years in the French army. He will resume practice as consulting engineer with the firm of Béique & Charton, Montreal. Captain Charton joined the French Army as a private, was promoted to Lieutenant in the Corps of Engineers in 1914, and in 1917 gained the rank of Captain. During his connection with the French Corps of Engineers, Captain Charton was entrusted with many important commissions, including an appointment as French-Adjoint to the chief railway construction engineer of the 4th British Army, later being appointed French-Adjoint to Base Sect. No. 1 of the A.E.F. Captain Charton is a member of La Société des Ingénieurs-Civils de France, and a member of the American Society of Civil Engineers.

New Chief Engineer for British Columbia

Patrick Philip, A.M.E.I.C., has been appointed chief engineer of the Department of Public Works for the Province of British Columbia. He succeeds A. E. Foreman, M.E.I.C., who recently resigned to go into private business in Vancouver.

The new chief engineer was born in Londonderry, Ireland, in 1882, and after a course in the Royal University of Ireland and an apprenticeship in civil engineering, came to British Columbia in 1907, taking a position on the Grand Trunk Pacific Railway near Prince Rupert on construction work. In 1910 he joined the staff of the city engineer, Vancouver, and during the construction period, 1910-1914, was employed principally on paving work. In 1917, when the system of engineers in charge of Districts was instituted by the Public Works Department, he was placed in charge of the Kamloops and Lillooet District, and in 1919 was brought back to the Coast to take charge of the Government paving programme on the Lower Mainland, and had direct supervision of the Pacific Highway, the Ladner Trunk Road, Kingsway, and the Lulu Island Road, all of which were recently opened to traffic.

Mr. Philip is also well known in professional associations, being a member of the Executive of the Vancouver Branch of the E.I.C., and a member of the Professional Engineers' Association of British Columbia. His diplomacy, tact, and good fellowship have gone a long way to make him popular with his fellow engineers, with contractors, and with the public generally; and in the larger sphere of influence they cannot but be of great assistance to him, now that he has become the professional adviser of the Government of British Columbia in their greatest spending department.

*

Toronto Branch Chairman

R. O. Wynne-Roberts, M.E.I.C., Chairman of the Toronto Branch, was born in Liverpool but with his parents moved to Llandudno, Wales.

He was originally trained as a gas engineer but later on became assistant town engineer of Llandudno. Seven years later he was appointed engineer of Carnarvon and after filling several offices there for about five years, he was selected out for over one hundred and twenty candidates to be engineer of Oswestry, Shropshire. There he became generally known among municipal engineers on account of his work in connection with the improvement of the water supply and as one of the pioneers in the development of bacterial treatment of sewage. His experimental work in this town attracted the attention of over one hundred deputations. The City Council of Oswestry accorded Mr. Wynne-Roberts public votes of thanks on three occasions.

In 1898 he was unanimously selected by the Capetown City Council over seventy candidates, to be its engineer. During a period of nearly nine years, he carried out several large works involving an expenditure of over $7,000,000., apart from controlling a large annual expenditure. He investigated ten water schemes, estimated cost ranging from $1,250,000. to $10,000,000. Full reports were issued and the City Council decided to carry out the one recommended, at an expenditure of $8,500,000., but a general financial depression set in after the Boer War and this work was postponed. When leaving Capetown, he received a large honorarium from the City Council and illuminated addresses etc. from various public bodies.

R. O. WYNNE-ROBERTS, M.E.I.C.
Chairman, Toronto Branch.

Returning to London, England in 1907, he practised as consulting engineer for four years and was employed by several municipalities in connection with sewerage, sewage disposal and several other works. He was twice appointed by the British Government (Board of Trade) as sole arbitrator to settle important disputes between several metropolitan municipalities concerning street railways, involving expenditures of over $5,000,000.

He came to Canada in 1911 and after spending several months visiting Canadian and American cities, was retained as consulting engineer to the City of Regina, Sask. He was also engaged by the Provincial Government of Saskatchewan to report on the problem of developing power from the lignite coal field. Several municipal authorities consulted him with regard to various municipal works.

He came to Toronto in 1915, and apart from being associated with Frank Barber, A.M.E.I.C., in connection with the development of the York Township Waterworks, involving an expenditure of $1,500,000. up to date, he has also been engaged by several municipal authorities. He is now a member of the Toronto firm of Messrs. Barber, Wynne-Roberts and Seymour, consulting engineers.

Mr. Wynne-Roberts is a Member of the Institution of Civil Engineers; American Society of Civil Engineers; Fellow of the Royal Sanitary Institute and is a frequent contributor to the press on a variety of municipal subjects.

BRANCH NEWS

Victoria Branch

H. M. Bigwood, A.M.E.I.C., Secretary-Treasurer.

At the annual meeting held on December 15th; Col. A. W. R. Wilby, A.M.E.I.C., took the chair, twenty-three members being present.

The Secretary read the minutes of the last regular meeting which were adopted as read. The Chairman then named Messrs. Icke and Bainbridge as scrutineers to count the ballots for Officers and Executive for the year 1921.

The Treasurer, E. Davis,M.E.I.C., here stated that owing to his absence from town he had not been able to attend the previous meeting when nominations were made, but his intention had been to resign from the position he was holding, he wished now to do so. The Chairman replying to Mr. Davis said that it was evidently no use trying to persuade him to continue to act and while he was sorry to have so to do, he would have to ask the meeting to make fresh nominations for the position of Treasurer as well as for Chairman which latter was necessary owing to Mr. Yarrow being unable to act.

The meeting was declared open for nominations:—*For Chairman* — E. G. Marriott, M.E.I.C. Mr. Marriott declared elected by acclamation. *For Treasurer* — E. P. Girdwood, M.E.I.C. Mr. Girdwood declared elected by acclamation.

The Chairman then called on the Treasurer to make his report of the financial position of the Branch. Mr. Davis presented his balance sheet, duly audited showing:

Balance, Dec. 1, 1919	$152.56
Receipts, 1920	319.32
	471.88
Disbursements	412.44
Balance in hand	$ 59.44

Total liquid assets $158.55.

The Balance sheet was adopted and a vote of thanks passed the Treasurer for his continued interest.

The Secretary, H. M. Bigwood, A.M.E.I.C., read his report together with some observations on the Branch's work. No discussion took place, but it was carried that copies be sent to all members.

The scrutineers being still wading through ballot papers, the Chairman at this point rose and welcomed to Victoria and the Branch H. L. Johnston, A.M.E.I.C., who was to reside here in future; he remarked in a few well chosen words on the position attained by Mr. Johnston in engineering and the pleasure it was to extend to him the welcome of the Branch. Mr. Johnston suitably replied, thanking the Branch, and particularly the members present for their reception of him.

The scrutineers now announced the result of the ballot for remaining officers and executive as follows:—

Vice Chairman,	E. N. Horsey, A.M.E.I.C.
Secretary,	H. M. Bigwood, A.M.E.I.C.
Executive,	E. F. Cooke, A.M.E.I.C.
	D. O. Lewis, M.E.I.C.
	J. B. Holdcroft, A.M.E.I.C.

Col. Wilby now called upon Mr. Marriott, the new Chairman, to take the chair, and in retiring wished to thank everyone associated with him during his short term of office which only commenced when Mr. Foreman retired in November. He welcomed the new Chairman and congratulated him upon his election, he was quite sure the Branch would be well governed.

Mr. Marriott took his place and thanked the members for the honour shown him. He was sorry that Mr. Yarrow had been unable to accept the position. Speaking of a matter which had been discussed previously, the possibility of the Branch being obliged to suspend activities, he read the present attendance as denoting a desire to continue and so asked for the active co-operation and assistance of every member. He would do his best, but alone could do very little.

As a member of the sub-committee on Salaries and Classification the Chairman stated that much work had been done and he hoped that a report and proposed schedule might be presented at the next regular meeting.

The first attempt at holding a luncheon has proved so successful that it was moved and carried that the scheme should become a regular feature for the first Wednesday in every month.

The Chairman proposed a very hearty vote of thanks to Col. Wilby on behalf of the Branch, which was endorsed by all present. A vote of thanks to the Secretary for his work was also proposed and carried.

After a general discussion on papers, visits and general policy of Branch, adjournment was moved and carried at 9.30 p.m.

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The members of the Branch met at luncheon on Monday December 27th. at noon for the purpose of wishing Godspeed to D. O. Lewis, M.E.I.C., a Past-Chairman of the Branch, Vice-President of *The Institute* and newly elected President of the Association of Professional Engineers of the Province of British Columbia.

Mr. Lewis, who occupied the position of district engineer for the Canadian National Railways on Vancouver Island, has been transferred to Toronto as maintenance of way engineer of the entire old Canadian Northern Railway system East of the Great Lakes.

The Chairman of the Branch for the coming year presided and after lunch was finished called upon Colonel A. W. R. Wilby, A.M.E.I.C., to express on behalf of the members, their appreciation of the services Mr. Lewis had rendered to the profession, and their regret at his impending departure. This duty was performed in a very pleasing manner and in the course of his remarks the speaker referred to the parting guest as one of the best representative engineers, and one who had done much by his interest and support to benefit the profession throughout the province.

E. N. Horsey, A.M.E.I.C., Vice-Chairman, endorsed the remarks of the previous speaker.

Mr. Lewis, replying, thanked everyone for their good wishes and expressed his regret at leaving British Columbia, where all his private interests were centered, and where some very pleasant years had been spent. He spoke for a few minutes on matters affecting the engineering profession, and particularly legislation. He reminded his hearers that although they had a Bill to regulate the practice of professional engineering in the province, it rested with themselves to prove its worth, both to the engineer and to the general public.

Concluding, he asked for continued support and active interest in *The Institute*, through the local branch, and for the newly organized Association of Professional Engineers.

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The regular meeting of the Branch held on Wednesday, Jan. 12th. had up for discussion as its chief business for the evening, the report of the committee on salaries and classification. About thirty members were present and an animated discussion took place, ending in a scale of minimum remuneration being adopted.

It was decided, upon recommendation of the executive, to hold the next luncheon, previously fixed for the first Wednesday in February, on the first Saturday at 1 p.m. instead. Dr. Plaskett, director of the Astro-Physical Observatory, Saanich, will be the speaker.

Upon the conclusion of the business a paper upon "Small Water Powers" was read by J. B. Holdcroft, A.M.E.I.C., which caused some discussion. Powers up to 1000 H.P. were dealt with.

*

H. L. Johnston, M.E.I.C., who has been appointed to succeed D. O. Lewis, M.E.I.C., as district engineer on Vancouver Island for the C.N.R., comes from Kamloops where he was, since 1911 with the exception of two years as district engineer at Vancouver for the Provincial Public Works Dept., divisional engineer with the same railway.

Vancouver Branch

J. N. Anderson, A.M.E.I.C., Secretary-Treasurer.

The Lieutenant-Governor in Council has appointed the following gentlemen to the Executive Council of the Association of Professional Engineers of the Province of British Columbia:—

Prof. E. G. Matheson, M.E.I.C., civil engineer, Vancouver, representing the University of British Columbia; Geo. Wilkinson, mining engineer, Victoria; E. A. Cleveland, M.E.I.C., civil engineer, Victoria; John Peck, mechanical engineer, New Westminster.

The above, with the names which appeared in the January issue of *The Journal*, constitute the Executive Council for the year 1921.

Calgary Branch

A. L. Ford, M.E.I.C., Secretary-Treasurer.

The Annual General Meeting of the Calgary Branch was held in the Board of Trade rooms on Saturday, December 4th, 1920. The meeting was preceded by a luncheon which was fairly well attended. The chief interest of the meeting centred around the two amendments to the by-laws which were read and approved by the meeting but which have to be voted on by letter ballot before they can go into effect. The object of the first of these amendments is to change the date of the Annual Meeting from the first Saturday in December to the first Saturday in March so that the incoming executive will have the summer season during which to prepare its program for the coming fall and winter season. This amendment was moved by P. J. Jennings, M.E.I.C., and seconded by A. L. Ford, M.E.I.C.

The second amendment was proposed by F. H. Peters, M.E.I.C., and seconded by G. N. Houston, M.E.I.C., and was for the object of facilitating the handling of applications for membership or transfer. It is proposed to have the Applications and Credentials Committee report to the Executive Committee which would take final action on behalf of the Branch, rather than having the Credentials Committee report to a general meeting which would vote on the applications. While the general feeling of the meeting was adverse to placing this additional power in the hands of the Executive it was felt that the action was necessary in order to avoid long delays in handling applications due to infrequent general meetings during the summer months.

In addition to the regular procedure in connection with annual meetings the only other business before the meeting was the discussion as to whether or not the Calgary Branch should appoint a committee on Classification and Remuneration of engineers. This discussion resulted in a motion by Mr. Jennings, seconded by Mr. Craig, that this meeting should instruct the executive to appoint a committee to report on the following points:—

(1) To establish a uniform system of grading positions.

(2) To establish a uniformity in titles with respect to duties performed.

(3) To establish a uniform compensation for positions of the same grading.

(4) To endeavor to raise the present inadequate scale of compensation for services rendered.

and any other points that the committee wished to cover. The Meeting also resolved to send Mr. Jennings to represent the Calgary Branch at Edmonton at a meeting to discuss classification and remuneration. The following officers were elected for the coming year:—

Chairman — G. N. Houston, M.E.I.C.
Secretary-Treasurer — A. L. Ford, M.E.I.C.
Executive — F. W. Alexander, M.E.I.C.
P. J. Jennings, M.E.I.C.
R. S. Trowsdale, A.M.E.I.C.
Past Chairmen — members without election.
P. Turner Bone, M.E.I.C.
G. W. Craig, M.E.I.C.

After Mr. Houston had taken the chair Mr. Craig asked an expression of opinion from the meeting as to holding more social gatherings during the winter. This met with general approval.

At a meeting of the Executive held immediately after the Annual Meeting the following standing committees were appointed:—

Committee on Applications and Credentials: F. H. Peters, Chairman, A. S. Dawson, A. S. Chapman, B. L. Thorne and F. W. Alexander.

Committee on Membership: — R. S. Trowsdale, Chairman, G. H. Whyte, F. E. Emery, A. I. Payne and H. E. Read.

Committee on By-Laws: — C. C. Richards, Chairman, A. S. Chapman, J. B. Riddall, V. Meek and B. L. Thorne.

Program Committee: — G. W. Craig, Chairman, F. K. Beach, R. C. Gillespie, G. P. F. Boese and W. B. Hutchison.

Legislation Committee: — F. H. Peters, Chairman, P. Turner Bone, Wm. Peerce, P. J. Jennings and A. S. Dawson.

Compensation Committee: — P. J. Jennings, Chairman, R. C. Gillespie, F. E. Emery, W. J. Gale and Harry Ingraham.

Committee on Policy to remain as appointed last year: — G. W. Craig, Chairman, A. S. Dawson and F. H. Peters.

The auditors appointed were F. K. Beach and W. J. Gale.

P. J. Jennings, M.E.I.C., tendered his resignation as a member of the Executive Committee as he could not undertake to give sufficient time. It was moved by G. W. Craig, M.E.I.C., and seconded by P. Turner Bone, M.E.I.C., that Mr. Jennings' resignation be accepted and that C. C. Richards, A.M.E.I.C., be appointed to fill the vacancy. Mr. Richards accepted the position on the Executive Committee and will act during the present year.

On December 13th the Executive Committee held another meeting at which there was a full turnout of the members. At this meeting there was a discussion as to the advisability of requesting that Mr. Keith, secretary of the parent Institute make a trip through the West during the coming spring. It was decided to ask the other Western Branches to co-operate with the Calgary Branch in placing this matter before the parent Society. It was also decided that there should be a general meeting of the Branch about December 29th to take the form of an electrical and mechanical demonstration night at the City Power House, refreshments to be provided and all University students in the city for their Christmas holidays and all engineers other than members of the Society interested in mechanical and electrical work to be invited. The Executive also decided to address the Minister of Education of Alberta asking him to outline in a general way the functions which it is expected the Provincial Institute of Technology to be built at Calgary will fullfil.

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On December 29th the first general meeting of the new Branch year was held at the City Power House. The success attending this meeting must have been very encouraging to the new Executive.

In order to provide an opportunity for the Calgary students of the University of Alberta to get in touch with *The Institute* this meeting was put on during the holidays and special invitations were sent to all the engineering students resident in or near Calgary. Through the courtesy of city engineer Craig, chief engineer of power house, McCall, and city electrical engineer, Brown, the Branch was able to provide a suitable evening's entertainment for the students and their other guests, who included mechanical and electrical engineers who have not joined *The Institute* and members of the Calgary Municipal Council. That the programme met with the general approval of the mechanical and electrical men of the city was proved by the fact that they constituted the larger portion of the one hundred present of whom only about thirty were members of the Branch.

The early portion of the evening was spent in a tour of the plant, each group of ten being accompanied by one of the power house officials who explained the automatic stokers, carrier systems and other special items of interest of the plant. A particular feature of this plant is the design of the fire grates and arch whereby the flames are carried over and under the as yet unburned coal drying out the high percent of moisture in the fuel. In this was a very low grade of coal, practically slack,, can be used. This is laid down at the plant at $2.50 per ton as compared to $7.67 per ton for bituminous coal. This means a large annual saving to the city.

This and other matters of interest in connection with the plant were explained by Mr. McCall in a short address after the tour had been completed. He drew attention to the further saving by the purchase of hydro-electric power purchased from the Calgary Power Company under an agreement which allowed the City to operate their steam plant with a high power factor.

Mr. Brown who has charge of the electrical energy after it has been delivered to the switchboard gave an interesting talk covering the distribution system from main switchboard to consumer. Mr. Brown's subject was a purely technical one but he handled it in such a manner as to make it interesting to the students.

F. H. Peters, M.E.I.C., gave a short history of *The Institute,* its aims and objects, for the benefit of the students.

The new chairman, G. N. Houston, M.E.I.C., expressed the thanks of the Branch to our hosts of the evening and then led the way to the refreshment room which had been installed at the back of the Power House.

The incoming Executive had announced it ast heir policy to combine the social with the technical in their program and the success of their first venture will encourage them in this course.

Winnipeg Branch

Geo. L. Guy, M.E.I.C., Secretary-Treasurer.

On 6th. January a meeting was held at the University Buildings, W. M. Scott, M.E.I.C., in the chair.

After the completion of the routine business W. Sanford Evans addressed the meeting on "Transportation Problems". The speaker dwelt in a very lucid manner on the fundamental conditions which affect transportation systems and discussed in detail the reason for certain routes being more heavily loaded than others, although from a casual investigation it would appear that the other routes were more favorable. He laid particular stress on the necessity for giving full consideration to all items which may affect the cost of transportation before coming to any definite conclusions as to which is the preferable route and showed the danger of reaching conclusions upon insufficient data. The address was one of the most interesting which the Branch has had the opportunity of listening to and a hearty vote of thanks to the speaker was unanimously passed by the meeting.

Owing to the annual meeting of the Professional Engineers of Manitoba being on the night of the next regular meeting of *The Institute,* Jan. 20th, 1921, it was decided to cancel the regular meeting of the Branch.

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On the 20th January the annual meeting of the Association of Professional Engineers of the Province of Manitoba was held at the University Building.

Ballots for the filling of positions vacated by three of the Council's term of office having expired were counted, resulting in the election of:

H. A. Dixon, M.E.I.C.
D. A. Ross, M.E.I.C.
W. M. Scott, M.E.I.C.

The Council now consisting of the following:

M. A. Lyons, M.E.I.C., President
P. O'D. Burke-Gaffney, M.E.I.C.
J. N. Legrand, M.E.I.C.
H. A. Dixon, M.E.I.C.
D. A. Ross, M.E.I.C.
W. M. Scott, M.E.I.C.
G. L. Guy, M.E.I.C., Secretary

Among the business done at the meeting was the adoption of the report of a Committee presenting a syllabus for examination for candidates for admission to the Association; the appointment of a Committee with authority to proceed with the organization of a technical library for the members of the Association; the offer of a scholarship to the Engineering Faculty of the University of Manitoba, the details of same to be settled between Council of the Association and the University authorities. The meeting also decided to appoint a standing committee to co-operate with the Engineering Faculty of the Manitoba University and to offer the assistance of its members in every way possible.

Border Cities Branch

J. E. Porter, A.M.E.I.C., Secretary-Treasurer.

The first regular monthly meeting of the Branch was held in the auditorium of the Chamber of Commerce, Friday evening, January 14th.

On the programme for the evening was: 1—An address by Capt. F. M. Dawson, A.M.E.I.C., of the Super Cement (America) Co.; 2—Discussion of the report of the Advisory Conference Committee on Engineering Leegislation.

This meeting was open to all those interested in the subjects for the evening. Many engineers unattached to *The Institute* were present.

Capt. Dawson addressed the meeting on "Recent Researches in Cements", illustrating his lecture by many microphotographs, showing the large percentage of incomplete hydration of ordinary cements and the improvement effected by Super Cement.

The meeting was then opened for discussion of the Advisory Conference Committee report. The main points of the proposed Bill were outlined by H. B. R. Craig, M.E.I.C., Chairman of the Ontario Provincial Division, and M. E. Brian, A.M.E.I.C., Branch representative of the Provincial Division. It was unanimously agreed that the proposed Bill be fully backed by the Border Cities Branch and that active steps be taken by the Branch executive to carry this support into effect.

Niagara Peninsula Branch

R. P. Johnson, A.M.E.I.C., Secretary-Treasurer.

A special meeting of the Executive was held on November the 5th to consider the questions of Salaries and Policy. Resolutions were prepared for submission to the Branch Meeting on Remuneration to be held on November the 18th.

It was resolved:—

"That the principle of more home rule for Branches be endorsed."

It was also resolved:—

"That in the opinion of this Executive the grade of Member may advantageously be changed to that of Fellow and the grade of Associate Member be changed to that of Member."

It was also resolved:—

"That in the opinion of this Executive the Provincial Divisions and Branches be urged to keep in close touch with Dominion, Provincial and Municipal Governments in the matter of appointing engineers to public positions and commissions."

It was felt that the method of electing officers and members of Council should be placed on a broader basis and

It was resolved:—

"That copies of a Resolution to this effect be sent to all Branches."

A Branch Meeting on Remuneration was held at Thorold on November the 19th. The meeting was addressed by A. H. Harkness, M.E.I.C., who explained the work of the Salary Committee. There was an interesting discussion and the following resolutions were passed.

Resolved:—

"That the Executive Committee of the Branch endorse and recommend for adoption the classification of engineers and the schedule of salaries set out on page 16 of the report of Engineering Council's Committee on "Classification and Compensation of Engineers" dated December the 15th, 1919."

Further resolved:—

"That the Executive of this Branch is opposed to the fixing of salaries for engineers above the grade of Assistant Engineer."

Further Resolved:—

"That in the specific case of engineers in government employ, that the Council of *The Institute* press upon the Government the necessity of revising the salaries of all grades in accordance with the schedule and of fixing a minimum for the higher grades."

The following resolutions were also passed.

"Whereas it is necessary, as a first step in attacking the question of remuneration, that the members at large should be assured of the full sympathy and co-operation of the Officers and Councillors in putting forth every means at the disposal of *The Institute* towards such steps as will tend to increase the Remuneration of Engineers."

Be it Resolved:—

"That the Executive Committee of the Branch strongly urge upon *The Institute* Committees on Remuneration and on Policy and the Council of *The Institute* the necessity of requiring every officer and councillor and every officer and member of Branch Executives to pledge themselves fully to endorse the principle of *The Institute*, using every means at his disposal for bringing about the higher standard of compensation of engineers in Canada, and further that they shall pledge themselves in this matter to their respective Branches on accepting nomination."

A regular meeting of the Branch, under the presidency of W. P. Near, M.E.I.C., the Branch Chairman, was held at the Engineers' Club, Thorold, on the evening of December 16th. 1920, to hear F. A. Dallyn, A.M.E.I.C. provincial sanitary engineer, present a paper on "A Metropolitan Water Supply Scheme for the Towns and Cities of the Niagara Peninsula."

Mr. Dallyn pointed out the probability of the Niagara Peninsula containing a large manufacturing population in the future, and emphasized the necessity of joint action amongst the Municipalities of the area to prepare in advance, plans for an adequate water supply. He presented a very comprehensive report of his studies on this question, and outlined a scheme which would ensure a safe and sufficient supply for the area, and which would be capable of future expansion.

The paper was illustrated with a large number of lantern slides, showing vital statistics, water analyses and diagrams of the schemes suggested by Mr. Dallyn.

The subject was of particular interest to members of this Branch, and an interesting discussion followed, in which W. P. Near, M.E.I.C., Branch Chairman, and city engineer of St. Catharines, Lt.-Col. R. W. Leonard, M.E.I.C., J. W. Purcell, J. H. Jackson, A.M.E.I.C., and E. P. Johnson, A.M.E.I.C., took part.

The meeting passed the following resolution:—

"That the Executive of the Branch be instructed to take action towards bringing the Metropolitan Water Supply Scheme for the Niagara Peninsula, to the attention of the various Municipal Councils, and to draw their attention to the necessity of taking joint action in connection therewith."

The Branch Executive Committee held a meeting on December the 29th at which it was decided to grant the Thorold Engineers Club $100.00 to apply on account of a financial arrangement to be made between the Branch and the Club in connection with quarters.

A Dance Committee was appointed and the sum of $200.00 voted to the Committee who were instructed to hold an Institute Dance at Niagara Falls, some time in January. It was not necessarily intended that the sum voted should cover the total cost of the Dance.

R. P. Johnson, A.M.E.I.C., was appointed to represent the Branch on the Executive of the Ontario Provincial Division for 1921.

A letter was read from the Secretary of the Ontario Provincial Division enclosing a copy of the report of the Advisory Conference Committee on Legislation for Ontario and asking that the Branch hold a meeting for the purpose of obtaining an expression of opinion from the membership in connection with the proposed bill. After considerable discussion it was decided that it would not be advisable to hold a meeting of the Branch to consider this question, until some further information was available. It was therefore decided to instruct the Branch Legislation Committee to ask for the following information from the Advisory Conference Committee.

1st. If it is intended to apply the act to chiefs of engineering organizations only, and if so why?

2nd. To what extent will the proposed legislation render engineers financially liable in the event of errors?

3rd. Are the fundamentals of the bill satisfactory in the opinion of the Committee?

The Branch Legislation Committee was further instructed to examine the bill with a view of detecting obscure features of a fundamental nature, and to obtain the intention of the Advisory Conference Committee from one or more of the E.I.C. representatives with regard to such features, and to be in a position to advise at a General Meeting of the Branch to be held as per request of the Secretary of the Ontario Provincial Division.

A letter from the Chairman of *The Institute* Salary Committee was read in which it was explained that Council had decided to defer action towards adopting a salary schedule, until after legislation in the Province of Ontario had been obtained.

A letter from J. B. Challies, M.E.I.C., re providing representation on Council for the smaller Ontario Branches, was read and referred to the Branch representative on *The Institute* Nomination Committee.

Toronto Branch

H. A. Goldman, A.M.E.I.C., Secretary-Treasurer

The first meeting of the New Year was called on January 6th to discuss the Proposed Draft Bill—"An Act Respecting Professional Engineers," which was presented for the approval of the Branch by members of the Advisory Conference Committee.

In presenting the bill Willis Chipman, M.E.I.C., outlined the development of the proposed measure. He said that members would probably not agree on all the details of the proposed measure but recommended that, as the general principles were taken care of, personal objections should be waived and the bill supported by all for the good of the profession. He referred to the withdrawal of the representatives of the Architectural profession from the Advisory Conference Committee and said that while their action was regrettable, yet it would place the matter of legislation on the same basis as in other provinces.

F. A. Dallyn, A.M.E.I.C., called the attention of the meeting to the fact that, under the Public Health Act of Ontario, recognition was given to the engineer as a professional man. His position was recognized in local improvement. Plans had to be prepared by an engineer.

J. C. Krumm, A.M.E.I.C., was glad to see that the interests of the younger engineers had been well looked after.

In the discussion which followed Messrs. C. R. Young, M.E.I.C., H. L. Seymour, A.M.E.I.C., Wm. Storrie, M.E.I.C., Frank Barber, A.M.E.I.C., G. G. Powell, M.E.I.C., E. M. Proctor, A.M.E.I.C., A. W. Connor, A.M.E.I.C., A. C. Oxley, A.M.E.I.C., A. B. Crealock, A.M.E.I.C., raised points of doubt regarding certain clauses.

F. R. Ewart, A.M.E.I.C., Secretary of the Advisory Conference Committee, in a very able manner answered all questions which has been raised. He thought that while the bill in all its details would not suit everyone, yet it would be better to agree on something and try to obtain legislation than to continue as at present without any legislation at all.

Peter Gillespie, M.E.I.C., heartily commended the bill and moved, seconded by F. A. Dallyn, the approval of the draft Bill in its broad general principles. The motion was unanimously carried.

Jan. 13th—Superheaters and Economisers.

F. A. W. Taylor addressed the Branch on "Superheaters and Economisers." He emphasized the economies to be secured from their use by reason of the increase in efficiency of the whole plant. As a measure of fuel conservation he advocated the closing of factories on Saturdays, as the cost of production for fuel was proportionately greater than that of any other period in the week.

Jan. 20th.—Reservoirs—Illustrated

W. Gore, M.E.I.C., presented a very interesting paper on "Reservoirs" to the Branch. The speaker discussed dams of every type for impounding reservoirs, and by slides showed some of the existing structures in England, France, United States, Panama, etc. He emphasized the various controlling factors in any proposed storage scheme for water supply or power development, and showed, by diagrams, the studies which have to be made for a preliminary investigation. The principles of design for dams of all heights were discussed and by reference to failures which had occurred, he showed that any departure from the rule of keeping the pressure lines within the middle third had almost unvariably met with failure.

Several members took part in the discussion which followed.

Policy Committee

E. T. Wilkie, M.E.I.C., Chairman

The Committee on Policy, after having thoroughly discussed the various questions of policy submitted to them, will in the near future present their report to the Branch Executive. This report will be based mainly on the points outlined by the Chairman of the Branch in his opening speech at the beginning of the season.

Membership Committee

F. B. Goedike, A.M.E.I.C., Chairman

There is a large number of engineers in Toronto who are not members of *The Institute* and who are not giving any support to movements which have for their object the improvement of the status of the profession. In view of this, a large Membership Committee is actively engaged in trying to remedy this state of affairs. Every member of the Branch should do something to help the work of this Committee, by seeing that his fellow engineer becomes a member.

Library Committee

A. C. Oxley, A.M.E.I.C., Chairman

This Committee has been enlarged in order to cope with the amount of work ahead. It will be the aim of the Committee to have the library as complete as possible. Members have access to the library at all times, and are requested to make full use of same.

Kingston Branch

W. P. Wilgar, M.E.I.C., Secretary-Treasurer.

PROGRAMME OF MEETINGS
November 1920 to April 1921

Tuesday, Nov. 2nd, 8 p.m.—
Co-operation in Engineering.
J. M. Campbell, M.E.I.C.,
Chairman-Elect
Technical Education.
Alexander Macphail, M.E.I.C.,
Retiring Chairman

Tuesday, Nov. 16th, 8 p.m.—
Frazil Ice.
John Murphy, M.E.I.C.,
Electrical Engineer, Department of Railways and Canals, Ottawa

Tuesday, Dec. 7th, 4.30 p.m.—
Density of Concretes.
F. M. Dawson, A.M.E.I.C.,
Monks, Manhard and Dawson, Consulting Engineers, Toronto

Tuesday, Jan. 18th, 5 p.m.—
Story of Rubber Tyre from Tree to Blowout.
H. W. Nicoll,
Educational Director, Goodyear Tyre Co.

Tuesday, Feb. 1st, 8 p.m.—
Economical design and operation of High Tension Transmission Lines.
W. P. Dobson,
Research Engineer, Ontario Hydro-Electric Commission, Toronto

Saturday, February 5th, 11 a.m.—
Practical Concrete.
Lt.-Colonel H. C. Boyden, M. A.S.C.E.

Tuesday, Feb. 15th, 8 p.m.—
Snow fighting.
W. H. Winterrowd, A.M.E.I.C.,
Chief Mechanical Engineer, Canadian Pacific Railway, Montreal

Tuesday, March 1st, 8 p.m.—
Some Early Theories and Practices in Engineering.
D. S. Ellis, A.M.E.I.C.,
Kingston

Tuesday, March 15th, 8 p.m.—
Annual Dinner, Kingston Branch,
Frontenac Club, Kingston.

Branch Officers
1920-1921

Chairman	J. M. Campbell
Vice-Chairman	A. Macphail
Sec.-Treas.	W. P. Wilgar

Queen's University, Kingston,
Phone 1138

Paper and Meetings Committee

D. S. Ellis, A.M.E.I.C., Chairman
A. Jackson, A.M.E.I.C., Secretary
A. L. Clark, A.E.I.C.
L. T. Rutledge, A.M.E.I.C.

Ottawa Branch

F. C. C. Lynch, A.E.I.C., Secretary-Treasurer.

Proof of the ever-increasing activities of the Ottawa Branch of *The Engineering Institute of Canada* was given to the very large gathering that assembled at the University Club on Jan. 14th for the engineers' annual meeting. G. B. Dodge, M.E.I.C., the retiring President of the Branch, presented a report which was received with great appreciation and enthusiasm by the many notable engineers present. Mr. Dodge stated that the Branch had held six luncheons and seven evening meetings during 1920 and among those who had addressed these gatherings had been A. P. Davis, president of the American Society of Civil Engineers, and R. A. Ross, M.E.I.C., president of *The Engineering Institute of Canada.*

The report further told how the protection of the public and of the engineer by suitable legislation had made marked progress during the past year, six of the nine provinces had accepted and passed as law the required legislation, and it was expected, said Mr. Dodge, that the year 1921 would see the same bill pass through the Ontario legislature and become applicable to the engineering profession of this province. The impetus and support given the professional institute of the civil service by engineers has resulted in the launching with excellent success of an organization which has a field of utility as wide as it is important.

Touching upon the financial standing of the Branch, it was shown that the monetary status of Ottawa center was extremely sound. The treasurer's report showed a substantial surplus. The membership roll has now reached 334, representing an increase of 19 during the past 12 months. The library, that now boasts of over 800 volumes on engineering matters alone, has been greatly used and the privilege that had been extended to anyone interested to consult the books had shown it to be a good scheme.

The Chairman's remarks to the effect that the local press had faithfully and regularly reported the activities of the Branch were greeted with much applause and a motion was unanimously adopted thanking *The Ottawa Citizen* for courteously opening its columns for this purpose.

The officers elected for the ensuing year were as follows: Chairman, C. P. Edwards, O.B.E., A.M.E.I.C., director of radiotelegraphs, Naval department; secretary-treasurer, F. C. C. Lynch, A.E.I.C., superintendent Natural Resources Branch, Interior department; Executive Committee, K. M. Cameron, A.M.E.I.C., assistant chief engineer, Department of Public Works; O. S. Finnie, A.M.E.I.C., mining engineer, Mining, Lands and Yukon Branch, Department of Interior; A. Ferguson, M.E.I.C., inspecting engineer, Department Railways and Canals;

M. F. Cochrane, A.M.E.I.C., hydro engineer, Dominion Waterpowers branch; J. E. Brown, M.E.I.C., superintendend, City Hydro-Electric.

1921 Activities

The new Chairman, in outlining the activities for the ensuing year, announced the "Engineers' Ball," which has been arranged to take place under the distinguished patronage of Their Excellencies the Governor General and the Duchess of Devonshire at the Chateau Laurier on Jan. 26. Commander Edwards further intimated that two papers of special public interest were to be read during the near future. One on "Ship Propulsion" was to be read by Engineer Commander T. C. Phillips, R.C.N., and the second, which was to be the annual popular lecture, was to be delivered by Colonel Steadman, chief technical adviser of the Air Board, and the subject arranged was relative to the aeroplane. Both papers are to be illustrated by slides and moving pictures, and the attendance of the general public was to be invited.

A Well Deserved Honour

The honour conferred on Commander Charles P. Edwards, O.B.E., A.M.E.I.C., in his election to the chief post of the Ottawa Branch of *The Institute* Engineers is a well-deserved one. Commander Edwards, although a Welshman by birth, has lived in this country for many years and married in 1911 an Ottawa girl, Miss Ethel Dickieson. The new Chairman has devoted over 11 years to the work of the Dominion radio service and the present high standard and splendid efficiency of this department is due to the untiring energies of this officer. Prior to his appointment in the government service, Commander Edwards was technical adviser on the staff of Signor Marconi, both in Europe and on this continent. In 1912 he was appointed Canadian delegate to the International Radio Conference and in 1920 he went to Washington as British delegate to the International Communication Conference. During the war Commander Edwards was in charge of the radio work of the country, and in return for the splendid results obtained through his devotion to duty the Order of the British Empire was conferred upon him.

Commander CHARLES P. EDWARDS, O.B.E., A.M.E.I.C.

C. P. Edwards, O.B.E., A.M.I.E., Director of Radiotelegraphs, Naval Service, was one of the British Delegates to the Preliminary International Conference on Electrical Communications, which has just completed its sittings at Washington. The five allied powers, Great Britain, France, United States, Italy and Japan were represented.

The subjects dealt with by the Convention were the allocation of the cables captured from Germany during the war; the preparation of a draft of the International Telegraph and Radiotelegraph Conventions for the next International Conference; and a general discussion of the world's facilities for telegraphic communication and improvements thereto.

Canada is deeply interested in the cable situation since one of the captured German Atlantic cables was cut 600 miles from New York and also in the English channel, one end being diverted into Halifax, N.S., and the other end into Penzance, England. This cable is now operated by the British Government and forms the final link in the Imperial chain from England to Australia. The matter of international law with regard to telegraphy and the standardization of cable landing rights and licenses was the subject of considerable discussion. The report of the Conference is now in course of preparation, but has not yet been published.

Montreal Branch

J. L. Busfield, A.M.E.I.C., Secretary-Treasurer.

The first Branch meeting in the year 1921 was held on January 7th, with Frederick B. Brown, M.E.I.C., presiding. The speaker of the evening was Charles F. Crandall, Managing Editor of the *Montreal Daily Star*, who gave an address of unusual interest, enlightened with many humorous comments. After referring to the many delusions about newspaper publication in the mind of the general public, the speaker traced the history of news dissemination from the days of the cave men, through Roman and Chinese developments, and later to the introduction of printing in Venice in 1450. In the early days freedom of opinion was a crime and it was not until 1811 that the legal principles which made modern journalism possible was established, namely, that the truth published in good faith and in the public interest without personal spite or malice is not libellous. In the early days there was no systematic method of news gathering of more than the intimate locality, and the speaker then described the development of the telegraph, and subsequent growth of the press agencies. In Canada every newspaper is a member of the Canadian Press and receives a combined service of Canadian and foreign news, in return for a price based upon the population of the area served by each individual paper. For foreign news the Canadian Press at present depends upon the American Associated Press, a system which the speaker deprecated on the grounds that it does not always carry the news that is wanted in Canada. In conclusion Mr. Crandall described the methods of transmission of news all over the world and the receiving and handling of it at the newspaper offices.

The address was preceded and followed by motion pictures loaned by the Laurentide Company, and by the Canadian Pacific Railway, the former showing log-driving and reafforestation, while the latter were mainly of the scenic variety.

On January 13th, G. H. Greenfield addressed the Branch on "Fire Prevention—The Engineer's Part". After describing many of the common structural defects tending to assist fires, the speaker dealt with the need for very careful preparation of the plans for new towns and villages as regards water supply, width of streets, etc. and provision at the outset of proper by-laws establishing fire limits and building regulations, also dealing specifically with the required class of buildings for certain occupancies. It was pointed out that there are many manufacturing processes going on, and buildings used for such purposes as garages where the structure is entirely unsuited to the class of work or occupancy, a procedure constituting a continuous menace both to the individual and to the community.

The speaker then dealt with the process of evolving a fire insurance rate on a building. The first item being the adoption of a standard or ideal practical condition of a standard building in a standard city, or environment, which requires certain first class conditions, such as high grade water supply, efficient fire and police departments, good fire alarm system, and also good building and fire prevention by-laws. A system of debits and credits was then described depending on whether the building to be insured was above or below the pre-determined standard.

As regards individual buildings the burden for poor construction involving fire hazards is apparently purely private as regards penalization by high insurance rates. Actually, however, the "Fire Tax" is distributed over the entire population of the country and exists as a small partially removable charge in the cost of every community. Reference was made to the amendment of the criminal code respecting fire prevention and how a person is now criminally liable if loss of property or life occurs through a fire originating on his premises and it can be proved that the owner or person responsible had failed to obey the requirements of any law intended to prevent fires, and which fire would not have occurred if such law had been observed. The work of the National Fire Protection Association was then outlined, the speaker explaining how the various technical committees evolved the different insurance regulations for dealing with all classes of fire hazards, and dealing with all regulations from the safe handling and storage of gasoline to the specifications for a fire safe apartment or tenement house.

The discussion was aptly opened by Colonel Gaudet, M.E.I.C., Director of Public Safety of the City of Montreal, who drew attention to the fact that the lack of limit upon the amount of insurance obtainable against fire loss was an inducement for unscrupulous persons to cause fires, especially in these days of depreciated values of stocks. He also recommended the formation of a board similar to the Board of Railway Commissioners to which disputes regarding fixed insurance rates for cities or districts might be taken. He thought that perhaps at present associated insurance companies possessed too autocratic powers in this respect.

On January 20th, a very interesting paper was read by S. C. Ells, A.M.E.I.C., Mining Engineer, Department of Mines, Ottawa, on the "Bituminous Sands of Alberta" following which there was a general discussion in which a large number of those present took part. The paper was preceded by a discussion by Branch members on the proposed change in Section 34 of *The Institute* by-laws, and it was resolved that the word "Residents" in the first paragraph be changed to "Montreal Branch Members", and also that the Montreal Branch suggest to Council that the fees of *The Institute* be not raised this year, and that a Committee be appointed to study the whole question.

St. John Branch

Annual Meeting of the Association of Professional Engineers of the Province of New Brunswick.

The Annual Meeting of the Association of Professional Engineers of the Province of New Brunswick was held in the Board of Trade Rooms in St. John on January 14th., C. C. Kirby, M.E.I.C., presided. There was a large and representative attendance of members from all over the province.

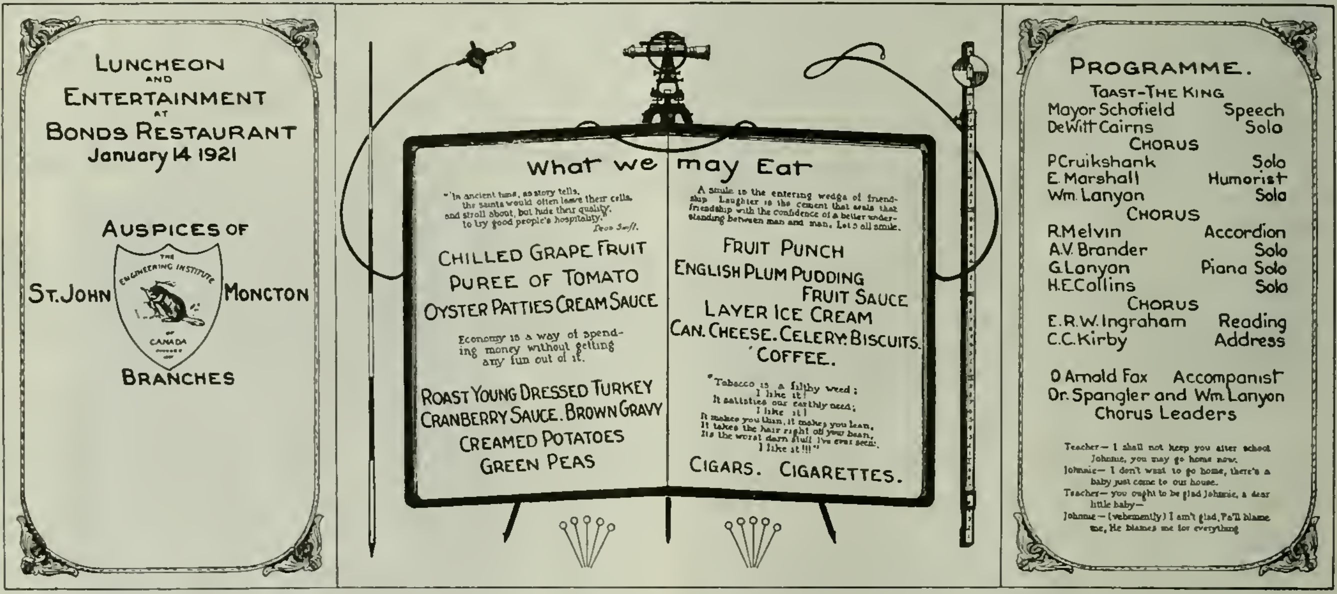
J. A. W. Waring, A.M.E.I.C., Secretary-Treasurer, read the minutes of the last Meeting and the Secretary-Treasurer's report for the year ending Dec. 31st. 1920. The report showed a net balance on hand of $1015.06. Mr. Kirby reported on the activities of the Council since the last meeting. These several reports were adopted.

The scrutineers reported the result of the election to be as follows: — President, C. C. Kirby, M.E.I.C., St. John, N.B.; Vice-President, W. A. Duff, M.E.I.C., Moncton, N.B.; Councillor for St. John District, F. P. Vaughan, M.E.I.C.; Moncton District, K. S. Pickard, A.M.E.I.C., Sackville, N.B. The meeting elected the following further committees: — Auditors, F. G. Goodspeed, M.E.I.C., and G. S. Macdonald, A.M.E.I.C.; Nominating Committees: — St. John District, G. G. Hare, M.E.I.C., and A. G. Tapley, A.M.E.I.C.; Moncton District, H. J. Crudge, A.M.E.I.C., and J. A. Ellis. Fredericton District: — C. A. McVey, A.M.E.I.C., and D. W. Burpee, M.E.I.C.; Chatham District (to be appointed by the chair).

Matters dealing with the enforcement of the Act throughout the Province. the progress of legislation in other Provinces, registration, seals, certificates, etc. were discussed.

The meeting adjourned at 6.00 p.m. to Bond's Restaurant where a dinner was served under the auspices of the St. John and Moncton Branches of *The Engineering Institute of Canada*. In the absence of Mr. Murdoch, Chairman of the St. John Branch, Mr. Kirby occupied the chair. Included with him at the head of the table were, His Worship Mayor E. A. Schofield and Commissioners J. H. Frink, T. H. Bullock, J. B. Jones and John Thornton, of the City of St. John, S. B. Wass, A.M.E.I.C., of the Moncton Branch, Alex. Gray, M.E.I.C., Past Chairman of the St. John Branch and Dr. Spangler of the St. John Rotary Club. Sixty-five members and guests were present. The unique menu and programme prepared by G. N. Hatfield, A.M.E.I.C., and staff immediately attracted the attention of everyone and brought forth many compliments.

The dinner soon made everyone feel in good spirits. At the conclusion of dinner, the toast to the King was drunk with musical honours. Mayor Schofield then thanked *The Institute* for its kind invitation. He spoke of economic conditions in the world today and asked each member to think of the other fellow and help him over the period of depression.



LUNCHEON
AND
ENTERTAINMENT
AT
BONDS RESTAURANT
January 14 1921

AUSPICES OF
ST. JOHN MONCTON
BRANCHES

THE ENGINEERING INSTITUTE OF CANADA

What we may Eat

"In ancient times, as story tells,
the saints would often leave their cells,
and stroll about, but hide their quality,
to try good people's hospitality."
Dean Swift.

CHILLED GRAPE FRUIT
PUREE OF TOMATO
OYSTER PATTIES CREAM SAUCE

Economy is a way of spending money without getting any fun out of it.

ROAST YOUNG DRESSED TURKEY
CRANBERRY SAUCE. BROWN GRAVY
CREAMED POTATOES
GREEN PEAS

A smile is the entering wedge of friendship. Laughter is the cement that seals that friendship with the confidence of a better understanding between man and man. Let's all smile.

FRUIT PUNCH
ENGLISH PLUM PUDDING
FRUIT SAUCE
LAYER ICE CREAM
CAN. CHEESE. CELERY. BISCUITS.
COFFEE.

"Tobacco is a filthy weed;
I like it!
It satisfies our earthly need;
I like it!
It makes you thin, it makes you lean,
It takes the hair right off your bean,
Its the worst darn stuff I've ever seen;
I like it!!!"

CIGARS. CIGARETTES.

PROGRAMME.

TOAST—THE KING

Mayor Schofield	Speech
DeWitt Cairns	Solo
CHORUS	
P Cruikshank	Solo
E. Marshall	Humorist
Wm. Lanyon	Solo
CHORUS	
R. Melvin	Accordion
A.V. Brander	Solo
G. Lanyon	Piano Solo
H.E. Collins	Solo
CHORUS	
E.R.W. Ingraham	Reading
C.C. Kirby	Address

O Arnold Fox Accompanist
Dr. Spangler and Wm. Lanyon
Chorus Leaders

Teacher—I shall not keep you after school Johnnie, you may go home now.
Johnnie—I don't want to go home, there's a baby just come to our house.
Teacher—you ought to be glad Johnnie, a dear little baby—
Johnnie—(vehemently) I ain't glad, Pa'll blame me, He blames me for everything

Joint Entertainment St. John and Moncton Branches, January 14th, 1921.

Commissioner Thornton stated that this was his first opportunity of meeting the engineers as a body, and he wanted to thank them for their assistance in the past. He had asked their help in his efforts to interest the people on a plan for the development of a real Civic Centre in the vicinity of King Square. Their committee had placed themselves at his disposal and they had taken steps which he was sure would lead to a group of Municipal Buildings flanking the Square which would be a credit to the City of St. John.

S. B. Wass, A.M.E.I.C., expressed the sentiments of the Moncton delegation in thanking those responsible for the splendid time they were having on this visit. He gave a report of the activities of the Moncton Branch since its beginning. Such gatherings as this were sure to result in the creation of a fraternal spirit among members of *The Institute* scattered throughout the province, the more general discussion of their various problems and the betterment of the profession. He regretted the unavoidable absence of the Chairman and Vice-Chairman of the Moncton Branch, as they would have been present if it had been possible. He felt that we should take the advice of Mayor Schofield and help others at the same time as we were endeavouring to help ourselves. Other members spoke of the pleasant gathering and after numerous musical and literary numbers, the meeting came to a close with the singing of Auld Lang Syne and the National Anthem.

Moncton Branch

M. J. Murphy, A.M.E.I.C., Secretary-Treasurer.

The regular monthly meeting of Moncton Branch was held at the Brunswick Hotel, Moncton, on Thursday evening, January 6th.

The meeting was preceded by a dinner at which, the speaker of the evening, Brigadier-General Mitchell, C.B., C.M.G., D.S.O., M.E.I.C., was the guest of honour. Amongst the invited guests were Mayor Chapman, J. C. O'Donnell, general superintendent of Canadian National Railways, J. A. Marven, President of Rotary Club, H. S. Bell, President of Board of Trade, Major A. S. Donald, D.S.O., President of G.W.V.A., Dr. A. R. Landry, Vice-President Canadian Club, Lieut.-Col. Boyd Anderson, C.M.G., D.S.O., Lieut.-Col. D. Sutherland and others. This was the first dinner meeting and was a great success, about eighty being present.

J. D. McBeath, M.E.I.C., Vice-Chairman of the Moncton Branch, presided and on behalf of the Branch welcomed General Mitchell who, he said has a large consulting practice in Canada, and is also consulting engineer to the Hydro-Electric Commissions in New Brunswick and Nova Scotia. Mr. McBeath also referred to General Mitchell's honorable career in the late War.

General Mitchell, who was accorded a hearty reception, said that *The Engineering Institute* is the engineering organization of Canada from coast to coast and embraces civil, mechanical, electrical, chemical, and all other professional engineers, the Moncton Branch being the 19th in the family.

The speaker referred to public utilities, and pointed out that agriculture must stand at the top of the list of industries, as it is the backbone of the country. The large basic public utility is transportation. He said: "Shipping will claim my first attention. You who were overseas will have a slight idea of the importance of shipping. We are proud of our merchant fleet and our naval fleet." Here the speaker referred to the terminals in Halifax, the harbour work and dry dock construction at St. John, harbour developments at Quebec and Montreal, the Great Lakes, the Toronto waterfront and on the Pacific Coast. The speaker next referred to canal development, speaking of the improvements of an important character that are being made in the Welland Canal.

General Mitchell then took up the question of engineering in its relation to the railways of the country. Railway construction was held up during the war. He referred briefly to the changes that have taken place in respect to amalgamation of railway interests, and spoke briefly of some projects that are proposed in the way of railway construction, referring to the James Bay Railway proposal, which is being talked of with a view to giving employment to those who are now out of work; also the Temiskaming and Northern Ontario railway.

The speaker next referred to electricity as a motive power, and spoke of developments in Toronto, the development of hydro-electric power in Ontario and the proposal to take over the radial system in that province as a government enterprise.

General Mitchell then discussed highway work, referring to the progress that is being made along this line in New Brunswick and Nova Scotia.

The speaker next took up the use of electric power for various purposes, referring particularly to development that is taking place in New Brunswick. The speaker prophesized a great future for Hydro-electric development. He referred to the work of that nature in Quebec and also to the Chippawa development in Ontario which would be completed shortly and would furnish from 400,000 to 450,000 horse power. He traced the development of power derived from Niagara from the earliest Canadian plant to the present time, the first plant producing about 30,000 horse power.

General Mitchell then spoke of the municipal phase of public utilities and referred to the problems confronting the city engineer. He must be a "Jack of all trades" and a politician as well. Incidentally he referred to town planning, and pointed out that it is of great importance in growing Canadian cities.

The speaker next dealt with the opportunities in bridge building. It is an important branch of the engineering profession. More and more bridges will be built as time goes on.

General Mitchell then spoke of architecture. Architecture has become divided into two parts, the artistic and practical. Many of the large offices have engineers attached to their staff.

The speaker referred to the nickel deposits of Northern Ontario and said the gold deposits of Nova Scotia should receive greater attention.

In speaking of the cement industry the speaker prophesied a large increase in the number of cement plants in the near future not because of the high price of cement, as that has to come down, but because of the demand, which will be very great.

In conclusion, General Mitchell again emphasized the importance of the engineer participating in the life of the community. He should be a public spirited citizen, capable of leadership.

W. B. McKenzie, M.E.I.C., in moving a vote of thanks to General Mitchell, paid a tribute to the lecturer's civilian and war services. A. F. Stewart, M.E.I.C., seconded the vote of thanks. The motion was presented by the presiding Chairman Mr. McBeath who stated the General's remarks would be a great stimulus to the Moncton Branch and trusted General Mitchell would be able to return at some future time and give the Branch some of his reminiscenses of the Great War.

In accepting the vote of thanks, General Mitchell said he would be pleased at some future time if it were possible to address the Moncton Branch again and endeavour to give them something interesting in the line of reminiscenses.

On January 14th the Annual Meeting of The Association of Professional Engineers of the Province of New Brunswick was held in the Board of Trade Rooms at St. John and the following were present from Moncton:— J. A. Ellis, H. J. Crudge, A. C. Selig, F. B. Fripp, R. J. Anderson, E. R. Evans, K. S. Pickard, S. B. Wass, A. S. Gunn, M. J. Murphy, and H. E. Barnett.

W. A. Duff, M.E.I.C., Chairman of the Moncton Branch was elected Vice-President; K. S. Pickard, A.M.E.I.C., was elected as member of the Council; H. J. Crudge, A.M.E.I.C., (Member of the Executive Committee) and J. A. Ellis were appointed as a Nominating Committee for Moncton District.

After the meeting all present adjourned to Bond's Restaurant where an excellent dinner and entertainment was provided. The members from Moncton District will always look back with pleasure to the 1921 annual meeting of the Association as everybody fully enjoyed his visit and voted the members of the St. John Branch as jolly good fellows and ideal hosts.

Cape Breton Branch

At a meeting held recently at Sydney, the following provisional officers were elected to hold office until the Annual Branch Meeting in May:—

Chairman . . .	C. M. Odell, M.E.I.C.
Secretary-Treasurer .	K. G. Cameron, A.M.E.I.C.
Executive . . .	T. J. Brown, M.E.I.C., H. F. Lawrence, A.M.E.I.C., D. S. Morrison, A.M.E.I.C.

Preliminary Notice

of Applications for Admission and for Transfer

22nd Jan., 1921

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in February, 1921.

FRASER S. KEITH, Secretary.

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*The professional requirement are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option Railway, Municipal, Hydraulic, Mechanical, Mining, or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-five years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits scientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

ADAMS—WALTER CHAMBLET, of Montreal, Que. Born at Montreal, August 21st, 1872; Educ., B.A.Sc., McGill Univ., Chemistry 1892, Mining 1894; 1895-99, engr. in charge of development work on properties in B.C. belonging to the Peto Company and its successor the Adams British Columbia Co.; 1899-1900, consultg. engr., Arlington Mines, Ltd., B.C. Also examining mining properties with the object of floating them; 1901, examining properties for self; 1903 (6 mos.), examining iron deposits in Colima and Michoacan, Mexico, for D. M. Barringer of Philadelphia; 1904 (May-Sept.), engr. for George Cushing at La Trinidad, Otaez, Durango. Mine closed; 1905 (May-Nov.), engr. and chemist for Las Vacas Mine, Durango, Mine Closed; 1905-08, chemist at the stamp and cyanide mill of Las Animas Mine, Durango; 1908 (May-Aug.), examining and developing "La Providencia," belonging to the Compania Minera de Providencia, Durango; 1908-09, examining mining properties for self and Dr. Milton L. Hersey, of Montreal; 1910, private business; 1911-12, supt. of cyanide plant, Santa Cruz Mine, Otaez, Durango; 1916 to date, chem.engr., Milton Hersey Co., Montreal.

References: A. E. Doucet, R. A. Ross, C. A. Mullen, F. McArthur, J. H. Larmonth, B. Aldrich, W. D. Baillairge, J. C. Kemp.

BARNETT—HAROLD EVANS, of Moncton, N.B. Born at Moncton, N.B., May 24th, 1897; Educ., B.Sc., Univ. of N.B., 1918; 1915 (June-Sept.), rodman, Can. Govt. Rlys.; 1917 (June-Sept.), asst., geol. survey of Canada; 1918-19, with C.E.F.; Dec. 1918 to July 1919, instructor in surveying, Can. Khaki College Staff, Witley Camp; 1919 to date, rodman, leveller and at present transitman, C.N.R., Moncton.

References: W. A. Duff, S. B. Wass, J. D. McBeath, J. A. Stiles, F. L. West, E. R. Evans.

BRADY—CASSIN, of Montreal, Que. Born at White, South Dakota, U.S.A., Jan. 14th, 1883; Educ., Mech. Engr'g. Diploma, I.C.S., 1899; 1899-1900 (5 mos.), tracer and dftsman with Whiting Foundry Equipment Co., Harvey, Ill.; 1900-05, dftsman and special ap'tice, mech. dept., Chicago Burlington & Quincy R.R. at Chicago and Aurora, Ill.; 1905-06, engr. of tests, Great Northern Railway at St. Paul, Minn.; 1906 (Sept.-Dec.), in charge of all mech. engr'g with Texas & Pacific Rly. at Marshall, Texas; 1906-10, asst. mech. engr., Rodger Ballast-National Dump Car Co. at Chicago; 1910-12, chief engr., Chicago Steel Car Co., Harvey, Ill., Designed and manufactured a variety of tank cars and car under-frames; 1912 to date, in charge of design of all cars for Canadian Pacific Railway.

References: W. H. Winterrowd, J. M. R. Fairbairn, H. H. Vaughan, W. S. Atwood, J. W. Orrock, J. A. Shaw.

BRINKMAN—FRANCIS LESLIE, of L'Orignal, Ont. Born at St. Thomas, Ont., Aug. 28th, 1893; Educ., B.Sc. (Honours), Queen's Univ., 1917; 1909-10 (summers), rodman, Michigan Central R.R., Windsor, Ont.; 1911-12-13, instr'man, City of St. Thomas; 1914 (summer), radial Branch, Ontario Hydro Electric; 1915 (summer), asst. engr., P.W.D., Fort William; 1916 (summer), surveys branch, Dept. Public Highways, of Ontario; 1917-19, overseas, Lieut. Can. Engr.; 1919 (June-Oct.), asst. city engr., Sarnia; 1919-20, asst. engr., Dept. Public Highways; June 1920 to date, engr. in charge of the Ottawa-Point Fortune Highway.

References: S. J. Chapleau, W. A. McLean, T. S. Scott, R. C. Muir, V. E. A. Belanger, G. Hogarth, G. C. Hoshal.

CORNELL—CHARLES WALTER, of Toronto, Ont. Born at London, Ont., March 14th, 1880; Educ., Grad. Civil Engr'g., Univ. of Toronto, 1911; 1902-05, elect'n., Toronto Rly. Co., and Scarboro Beach Park Co.; 1905-07, dynamo tender & switchboard operator, Toronto Rly. Co.; 1908 (summer), 1st asst., survey party, Dept. of Indian Affairs; 1909 (summer), elect'n., Cobalt Hydraulic Power Co.; 1911 (6 mos.), charge of survey party for Brownlee & Nash, Surveyors, Vancouver; 1911-12, waterworks dept., City of Vancouver; 1912-13, Supt., B.C. Grainloid & Contracting Co., Engrs. & Contractors, Vancouver; 1913-15, mgr., Jones-Cornell Constrn. Co., Engrs. & Contractors, New Westminster, B.C.; 1915-16, supervisor of inspection, Can. Inspection & Testing Labs.; 1916-18, testing engr., & district inspector, shrapnel forging, Ministry of Munitions; 1918, charge of testing & heat treating plant, British Forgings Co.; 1919 to date, district engr. of county roads, Province of Ontario.

References: W. A. McLean, T. S. Scott, R. C. Muir, J. A. P. Marshall, P. Gillespie, C. R. Young, F. B. Goedike, A. Sedwick.

FLAY—WILLIAM HENRY GEORGE, of Ottawa, Ont. Born at Exeter, England, Nov. 16th, 1885; Educ., Exeter University College Technical School; 1912 (May-Nov.), dftsman., Ch. Engr's Dept., C.P.R.; 1912-14, dftsman, Dominion Bridge Co., Lachine; 1914 (May-Oct.), inspector, Canadian Inspection Co., Montreal; 1914-17, dftsman., struct'l. steel work, Ch. engr's dept., N.T.C. Rly., Ottawa; 1917-19, dftsman, Imperial Munitions Board; 1919 (Jan.-Apr.), ch. dftsman., Lauzon Engr'g. Ltd., Levis, Que.; 1919 (May-Aug.), dftsman., British America Nickel Corp., Deschenes, Que.; At present struct'l. engr., City of Ottawa Public School Board.

References: G. Grant, A. Ferguson, R. J. Durley, R. C. F. Alexander, R. Henham, C. E. White.

GUNN—ANGUS STIRLING, of Moncton, N.B. Born at East River, St. Mary's, N.S., Oct. 29th, 1884; Educ., 2 yrs. applied science, Dalhousie Univ., Civil engr's course I.C.S.; 1907-08, rodman, T. C. Ry.; 1908 (Apr.-Dec.), Instr'man, T. C. Ry.; 1908-11, bridge engr., T.C. Ry.; 1911-12, engr. for James H. Corbett, Contractor, on Moncton Terminals; 1912 (July-Sept.), res. engr., N.T.C. Ry.; 1912-16, transitman and dftsman, Can. Govt. Rlys.; 1916-19, overseas, Lieut. Heavy Artillery; Oct. 1919 to date, asst. engr., C.N.R. (Member Assn. of Prof. Engrs. of the Prov. of N.B.).

References: C. O. Foss, S. B. Wass, C. B. Brown, W. A. Duff, H. Longley, L. H. Wheaton, R. H. Cushing.

HADLEY—ARTHUR, of Toronto, Ont. Born at Normanton, Yorkshire, England, Mar. 12th, 1887; Educ., Holloway Polyetchnic, 1st class in bldg. constrn.; 1907-10, articled to T. England, Engineering & Surveyor, Branet Rural District Council; 1 year as asst. to above; 1912-14, rodman, C.P.R. prelim. survey; 1916-19, overseas; At present dftsman., hydraulic dept., H.E.P.C. of Ontario.

References: M. V. Sauer, R. M. Carmichael, R. Morham, W. Harland, A. E. Nourse.

HOPPER—GARNET HENRY, of Niagara Falls, Ont. Born at Deseronto, Ont., Dec. 31st, 1893; Educ., B.A.Sc., Univ. of Toronto, 1919; Geological Survey 1918. Mech. engr'g with B. H. Pracks, Arch'ts. & Engrs., and Canadian Fabrikoid.

References: E. E. Down, C. H. McDougal, K. C. Fellowes, P. Gillespie.

HUGHES—CHESTER ARTHUR, of Mimico Beach, Ont. Born at Toronto, Ont., Sept. 20th, 1896; Educ., B.A.Sc., Univ. of Toronto, 1920; 1914 (summer), rodman, dept. of roadways, City of Toronto; 1919 (2 mos.), instr'man, Toronto Harbor Comm'n.; 1920 (summer), dftsman, dept. of roadways, City of Toronto; At present demonstrator, dept. of applied mechanics, Univ. of Toronto.

References: P. Gillespie, C. R. Young, T. R. Loudon, W. J. Smither, M. C. Hendry.

JENNINGS—ROBERT BERNARD, of Toronto, Ont. Born at Paris, Ont., June 29th, 1888; Educ., 2 yrs. Faculty of Applied Science, Univ. of Toronto; 1904 (3 mos.), Toronto & Niagara Power Co.; 1905 (2 mos.), timekeeper, C.P.R.; 1906 (3 mos.), C.N.R.; 1907 (5 mos.), rodman, G. T. P.; 1908 (5 mos.), instr'man, G.T.P.; 1909 (5 mos.), leveller, C.N.R.; 1909-15, res. engr. on constrn., C.N.R.; 1916-19, overseas, Major, Can. Rly. Troops; 1919 to date, divn. engr. (mtce.), Toronto Division, C.N.R.

References: A. F. Stewart, H. T. Hazen, G. P. MacLaren, R. A. Baldwin, J. R. Mackensie, W. G. Campbell.

LACROIX—EMILE, of St. Eustache, Que. Born at Montreal, Que., Aug. 1885; Eudc., B.A.Sc. (C.E., M.E.), Ecole Polytechnique, 1910; 1908-09 (8 mos.), instr'man. for E. Vanier, C.E.; 1910 to date, asst. city engr., City of Outremont.

References: deM. J. Duchatel, A. Surveyer, E. Vanier, P. A. Beique, F. C. Laberge.

LOGIE—ERNEST ROY, of Toronto, Ont. Born at Chatham, N.B., Aug. 16th, 1886; Educ., 3 years civil engr'g. at Univ. of N.B.; 1906-07, dftsman, rodman, instr'man, G. T. Ry., Winnipeg and Edmonton, 1909-10, dftsman. instr'man, etc., B. & A. R.R., Maine; 1911-12, topog'r and instr'man, Algoma Central Rly., Sault Ste. Marie, Ont.; 1912-17, res. engr. on constrn., C.N.O. Ry., & Toronto Suburban Rly.; 1917-18, res. engr. on constrn., Toronto, Hamilton & Buffalo Rly.; 1919-20, res. engr., mtce. of way, C.N.R., Toronto; 1920 (Feb.-Nov.), divn. engr., C.N R., Hornepayne, Ont.; At present asst. engr., C.N.R., Toronto, Ont.

References: H. T. Hazen, G. P. MacLaren, J. R. Mackenzie, S. McIlwain, E. T. Wilkie, R. L. Latham.

LUTZ—GEORGE HAROLD, of Moncton, N.B. Born at Moncton, March 3rd, 1893; Educ., B.Sc., Acadia Univ., 1914, B.Sc., McGill Univ., 1916; 1916-19, Lieut., C.F.A.; 1920 (June-Sept.), rodman, C.N.R.; Sept. 1920 to date, leveller, C.N..R, Moncton.

References: W. A. Duff, S. B. Wass, F. L. West, E. Brown, J. D. McBeath.

MacKAY—GORDON DIMOCK, of Moncton, N.B. Born at Truro, N.S., Dec. 12th, 1899; 1917-20, rodman, May 1920 to date, dftsman, C.N.R.

References: W. A. Duff, S. B. Wass, F. L. West, R. H. Smith, C. W. Archibald.

MacLACHLAN—WILLIAM ALTON, of Toronto, Ont. Born at Montreal, Que., May 10th, 1888; Educ., B.A.Sc., Univ. of Toronto, 1914, 1 yr. mining, Univ. of Toronto; 1907 (5 mos.), T. & N. O. Rly.; 1910-11, Kerr Luke Mine; 1912-13, mining contracting; April 1919 to date, chief dftsman., Highways Dfting Dept., Toronto.

References: W. A. McLean, G. Hogarth, C. S. L. Hertzberg, P. Gillespie, E. G. Hewson.

McCOUBREY — JAMES ADDISON, of Shaunavon, Sask. Born at San Salvador, Spain, July 29th, 1882; 1904, with location party C.P.R.; 1905, rodman, C.P.R. constrn.; 1905-06, topog'r., N.T.C. Ry.; 1906-10, instr'man., N.T.C. Ry. & C.P.R.; 1910-13, asst. engr. on constrn., C.P.R.; 1915-19, municipal work; 1919 to date, res. engr. on constrn., Consul South Easterly Line, C.P.R.

References: W. A. James, N. B. MacTaggart, T. C. Macnabb, M. McKenzie.

McISAAC—RONALD, of Moncton, N.B. Born at Antigonish, N.S., Oct. 30th, 1885; Educ., Passed 2nd year engr'g., St. Francois Xavier College and special course on 3rd year subjects, 1904-07; 1907-08, rodman on constrn., T. C. Ry.; 1908-12, instr'man on constrn. T. C. Ry.; 1912 (Jan.-Apr.), dftsman on location St. John & Quebec Rly.; 1912-14, res. engr., above railway; 1914-16, private practice; 1917-19, transitman on mtce., Con. Govt. Rlys.; 1919 (Apr.-June), transitman on location, C.N.R.; June 1919 to date, asst. engr. in charge of survey party, C. N. R.

References: B. M. Hill, S. B. Wass, C. O. Foss, R. McManus, W. A. Duff, F. L. West.

McMILLAN—DAVID, of Ottawa, Ont. Born at Templeton, Quebec, April 20th, 1888; Educ., private study of Geodetic surveying and mathematics; 1908-10, asst. to C. A. Biggar, D.L.S.; 1910, in charge of reconnaissance party selecting triangulation stations in Georgian Bay, Ont., district; 1911-20, in charge of Geodetic Survey precise levelling parties in Western Canada.

References: J. J. McArthur, J. D. Craig, N. J. Ogilvie, F. B. Reid, W. M. Tobey, D. H. Nelles, J. L. Rannie.

MENZIES—JOHN WHYTE, of Ottawa, Ont. Born at Pembrooke, Ont., Dec. 2nd, 1884; Educ., B.Sc., McGill Univ., 1910; 1908 and 1909, magnetic surveys, C. P. R. and I.C.R.; 1911, asst. on International Boundary survey; 1910, in charge of magnetic survey in Western Ontario; 1912 and 1913, in charge of International Boundary survey parties; 1914-15, in charge of triangulation and tower bldg. on geodetic survey in New Brunswick; 1916-19, overseas, Lieut. & Capt., Can. Engrs.; 1919-20, in charge of reconnaissance on geodetic survey in N.B.

References: J. J. McArthur, N. J. Ogilvie, J. D. Craig, F. B. Reid, J. L. Rannie.

MUELLER—VICTOR LEO, of Toronto, Ont. Born at Hamilton, Ont., Jan. 26th, 1895; Educ., 2 years night school, Buffalo Technical, Buffalo, N.Y.; 1912-15, 3 yrs. ap'ticeship, Hamilton Bridge Co., Hamilton; 1 year Hamilton Bridge Co. and 1 year Ferguson Steel & Iron Co., Buffalo, N.Y.; 1917-18, struct'l design, Esenwein & Johnson, Buffalo; 1918 to date, checking and designing struct'l work, Dominion Bridge Co., Toronto.

References: R. E. W. Hagarty, J. W. Smith, A. H. Harkness, W. W. Gunn, G. E. Evans.

NEFF—GORDON MONROE, of Niagara Falls, Ont. Born at Lowbanks, Ont., Nov. 20th, 1899; Educ., At present taking course in civil engr'g., I.C.S.; 1916-19, overseas; March 1919 to date,with H.E.P.C. as rodman, asst. instr'man., and at present field dftsman.

References: A. C. D. Blanchard, F. W. Clark, W. S. Orr, C. H. McDougal, R. P. Johnson, A. D. Huether, S. W. Johnston.

NOWLAN—BRETE CASSINS, of Montreal, Que. Boro at Reasnot, Iowa. U.S.A., May 28th, 1878; Educ., B.Sc. (E.E.) Iowa State College, 1900; 1900-01, erection of small electrical power units and telephone plants; 1902-07, constrn. foreman, Telephone Central Offices at Fargo, N.D., Egansville, Ind., Chicago and elsewhere; 1908, preparations of specifications for telephone systems; 1911 to date, preliminary and final studies in the sale of telephone systems throughout Canada; At present asst. telephone sales mgr., Northern Electric Co. Ltd., Montreal.

References: F. A. Bowman, J. S. Cameron, J. H. Winfield, W. A. Winfield, P. F. Sise.

PICKLES—ERNEST, of Toronto, Ont. Born at Bradford, England, Nov. 12th, 1888; Educ., Armstrong Technical Institute, Newcastle-on-Tyne, England; 7 years ap'ticeship in Sir W. G. Armstrong Whitworth & Co's. Engr'g. Works, Newcastle-on-Tyne; 1 year asst. shop mgr. on automoble constrn.; 4 years in charge of drawing office, Canadian Boving Co., Hydraulic Engrs., Toronto; 6 years, H.E.P.C. of Ontario; At present mech. engr., hydraulic dept., H.E.P.C.

References: H. G. Acres, T. H. Hogg, M. V. Sauer, A. E. Nourse, W. Harland, R. Morham.

RAMSAY—DAVID GORDON, of Napanee, Ont. Born at Mount Forest Ont., July 25th, 1894; Educ., B.Sc., Queen's Univ., 1919; 1915-19, overseas; 1919-20 (5 mos.), dftsman., E. A. James Co., Toronto; 1920 (Feb.-May), efficiency engr., Northern Aluminum Co. of Canada; May 1920 to date, instr'man, Dept. of Public Highways of Ontario.

References: W. P. Wilgar, W. L. Malcolm, D. S. Ellis, A. Jackson, T. S. Scott, E. M. Proctor.

ROBERTSON—TOM, of Toronto, Ont. Born at Glasgow, Scotland, May 28th, 1881; Educ., Course in Naval Architecture, Fairfield Shipbldg. Co., Glasgow; 1901-03, naval architect for Bertram Engine Works, Toronto; 1904-05, Richelieu & Ontario Navigation Co., Sorel, Que.; 1906-09, Polson Iron Works, Toronto; 1909-13, Canada Foundry Co., Toronto; 1913 to date, with D. B. Co., Toronto. At present in charge of work in struct'l engr'g. dept.

References: E. S. Mattice, G. E. Evans, W. W. Gunn, J. W. Smith, J. G. Jack, A. H. Harkness.

ROUTLEDGE—GEORGE GRAHAM, of Toronto, Ont. Born at Hardhurst, Cumberland, England, April 2nd, 1870; Educ., Paisley Technical College; 1889-1894, employed by British Govt. on ordnance survey of Great Britain; 1894-99, in charge of sections of ordnance surveyors; 1899-1912, design and constrn. of water supply mains, storage reservoirs, sewers, street widening & paving, Paisley, Scotland; 1912-19, in charge of Pitometer Survey of water mains and on the supervision of water distribution system of the City of Toronto; At present, supt. of Water District Section of the Works Dept., City of Toronto.

References: C. L. Fellowes, W. Gore, J. Milne, G. G. Powell, M. A. Stewart, W. Storrie, R. O. Wynne-Roberts.

SAUNDERS—CLARION SPENCER, of Montreal West, Que. Born at Turkey City, Penn., U.S.A., Aug. 13th, 1874; Supt. of constrn. in charge of all constrn. work for the Shawinigan Water & Power Co. for the past twenty years. At present, gen. mgr., The Shawinigan Engineering Co. Ltd.

References: J. C. Smith, R. S. Kelsch, S. Svenningson, R. M. Wilson.

SMITH—ROBERT MELVILLE, of Toronto, Ont. Born at Kingston, Ont., Oct. 14th, 1887; Educ., B.Sc., Queen's Univ., 1914; 1911-12-13 (summers), asst. prov. topog'r.; 1914, asst. engr., Dept. of Public Highways; 1915-18, engaged in investigation of road materials in province; 1918-20, res. engr. in charge of constrn. on prov. highway, Trenton to Kingston; 1920 to date, divisional engr., Dept. of Public Highways, in charge of constrn. in north and central portion of province.

References: G. Hogarth, W. A. McLean, H. T. Routly, E. A. James.

STADLER—JOHN, of Shawinigan Falls, Que. Born at Eggolfiog, Bavaria, April 2nd, 1874; Educ., Engr'g. Diploma, Polytechnical Institute, Munich, 1894. Special Course in Elect'l. Engr'g., Technical Institute of Mittweida, Saxonia, 1895; 1896-97, with Schuckert Co., Nuremberg, and Engr'g. Work, Augsburg, Bavaria, as volunteer ap'tice and research work on internal combustion work; 1898-1900, with Helios Co. of Vienna, Austria, as designing engr. of hydro-electric and gen. mfg. plants, later as supervisor on install'n work; 1903-06, with Shaw. Water & Power Co. on hydro-elec. work and as supt. of Shawinigan Falls Power House; 1906-11, engr. of plant in full charge of design and constrn., Belgo Canadian Pulp & Paper Co.; 1912 to date, asst. mgr., of above company, in full charge of mfg. activities, including designs and new constrns.

References: J. C. Smith, W. I. Bishop, R. S. Kelsch, J. M. McCarthy, H. O. Keay, G. H. Duggan, C. B. Thonne, J. A. DeCew.

THOMPSON—HEDLEY VICARS, of Toronto, Ont. Born at Oxford, N.S., May 9th, 1859; Educ., B.A., Mount Allison Univ. 1882, B.A.Sc., McGill Univ., 1885; 1885 (May-Dec.), Montreal Harbor Works; 1886-90, C. B. & Q. R. R., Chicago Office; 1890-92, Keystone Bridge Co., Chicago Office; 1892-1909, bridge & structural work as squad foreman in dfting dept., chief dftsman, designing engr. and plant engr. with the following concerns—New Jersey Steel & Iron Co., 8 years, Trenton Iron Co., 3 years, American Bridge Co., 6 years; 1909-14, designing engr., bridge dept., Canada Foundry Co.; 2 years, bridge engr., Toronto & Hamilton Highway Commission; Since 1914 in charge of struct'l design or reporting on existing or proposed bridges for Canadian Allis Chalmers Ltd., Norman McLeod Ltd., Ontario Railway & Municipal Board, City of London, Ont., and City of Hamilton, Ont.; At present Consultg. Engr.

References: E. R. Gray, N. M. McLeod, T. K. Thomson, G. Hogarth, J. G. G. Kerry, P. Gillespie, A. H. Harkness.

WILBUR—GEORGE PERCIVAL, of Toronto, Ont. Born at Victoria Harbor, Ont., Dec. 7th, 1888; Educ., Home study, I.C.S.; 1908-09, hull dftsman., Polson Iron Works, Toronto; 1910-11, struct'l steel dftsman., Canada Foundry Co., Toronto; 1912 (6 mos.), checker, Toronto Struct'l Steel Co.; 1912-13, checker Canada Foundry Co., Toronto; 1913-15, checker, struct'l drawings and in charge of work, Dominion Bridge Co., Ltd., Toronto; 1916-17, asst. chief dftsman., Dominion Bridge Co., Toronto; 1918 to date, chief dftsman, above company.

References: G. H. Duggan, E. S. Mattice, G. E. Evans, W. W. Gunn, J. W. Smith, A. H. Harkness, A. R. Robertson, R. E. W. Hagarty.

WIMBERLEY—ARTHUR CECIL, of Ottawa, Ont. Born at High Bluff, Man., July 5th, 1895; Educ., Toronto Matric. 1912; 1913 to date, engr'g clerk, irrig. branch, Dept. of the Interior, Ottawa, Season 1920, instr'man and part of time in charge of party.

References: R. J. Burley, J. S. Tempest, G. F. Horsey, H. R. Cram, W. C. Gillis, H. R. Carscallen, J. H. Byrne.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER OT THAT OF MEMBER

BARBER—FRANK, of Toronto, Ont. Born at Milton, Ont., Dec. 27th, 1875; Educ., Diploma, Faculty of Applied Science, Univ. of Toronto, 1906; Ap'ticed under late Jas. McDougall, York County Engr., engaged in electric rly. surveys and bridge design; 1908, established private consltg. practice; 1909-11, in partnership with Prof. C. R. Young; 1908-20, responsible charge of over 200 bridges in various parts of Canada; At present consltg. engr. and senior member of firm, Barber, Wynne-Roberts & Seymour, also engr. for various counties and townships in Ontario.

References: C. R. Young, C. H. Mitchell, E. L. Cousins, A. F. Macallum, R. H. Parsons, W. Chipman, A. H. Harkness, W. A. McLean.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

DAWSON—KENNETH LOCKHART, of Halifax, N.S. Born at Halifax, N.S., Jan. 7th, 1893; Educ., B.Sc. (C.E.), Nova Scotia Technical College, 1917; 1910, stenog & Clerk, office of gen. supt., C.P.R., Calgary; 1911-12, agent, west Canadian Collieries Ltd., Blairmore, Alta.; Timekeeper, classification clerk, and labor foreman, successively for the J. S. Metcalf Col Ltd., Montreal, at West St. John Grain Elevator, and at Charlottetown, P.E.I., Cathedral of St. Dunstan's; 1914 (Apr.-Nov.), foreman with J. S. Metcalf Co. on re-constrn. of St. Dunstan's Cathedral; 1916 (May-Oct.), instrman and dftsman, with W. E. Barrett, Consultg. Engr.; 1917 to date, asst. supt., gas dept., N.S. Tramways & Power Co. Ltd., Halifax, N.S. At present in charge of gas works operation and mtce.

References: F. R. Faulkner, I. P. MacNab, J. B. Hayes, R. R. Murray, C. A. DeW. Fowler, F. L. West, R. C. Moore, F. A. Bowman, J. W. Roland, K. H. Smith, O. S. Cox, R. P. Freeman, G. S. Stairs, J. F. Lumsden, F. H. Palmer.

McFARLANE—WILLIAM THOMPSON, of Ottawa, Ont. Born at St. Stephen, N.B., July 17th, 1887; Educ., Grad. R.M.C., 1908; 1908-09, rodman on constrn., G.T.P.; 1909-10, asst. engr. to the late Major A. W. Agnew, Prince Rupert; 1910-14, in charge of land surveys for Ritchie, Agnew & Co., Prince Rupert; 1914-19, overseas; At present asst. engr., reclamation service, Dept. of the Interior.

References: R. J. Burley, J. S. Tempest, A. C. Wright, G. F. Horsey, W. C. Warren.

NOONAN—WILLIAM FLEMING, of Napanee, Ont. Born at Kingston, Ont., Aug. 31st, 1890; Educ., B.Sc. (C.E.), Queen's Univ. 1914; 1912 (summer), C.N.O. Ry.; 1913 (summer), instr'man, Trent Canal; 1915-18, civil dftsman, Militia Dept., Kingston; 1918-19, constrn. engr., Deloro Smelting & Reduction Co., Deloro; 1919 (May-Sept.), asst. city engr., Kingston, Ont.; Oct. 1919 to May 1920, asst. engr., and May 1920 to date, res. engr., Dept. Public Highways of Ontario, Kingston, Trenton Section.

References: G. Hogarth, A. Macphail, W. L. Malcolm, R. J. McClelland, W. H. Losee, T. S. Scott.

WELDON—RICHARD LAURENCE, of Montreal, Que. Born at Winnipeg, Man., Nov. 27th, 1894; Educ., B.Sc. (Mech. Eng.), McGill Univ. 1917; British Assn. Medal and Honours on grad. M.Sc., McGill Univ.; 1913 (summer), tracer, Manitoba Bridge & Iron Works; 1914 (summer), elect'n., contracting for self; 1915 (summer), mach. shops, G. T. P. Ry.; 1916 (summer), mech. dftsman, Nova Scotia Steel & Coal Co., New Glasgow, N.S.; 1917 (summer), mech. dftsman, Can. Electric Products Co., Shawinigan Falls; 1917-18, demonstrator in mech. engr'g., McGill Univ.; 1918 (June-Sept.), special designer, Peter Lyle & Sons Constrn. Co.; Sept. 1918 to Jan. 1919, asst. metallurgist with same company; 1919-20, mech. engr., Laurentide Co., Grand'Mere; 1920 (Aug.-Dec.), res. engr., Fort Francis Pulp & Paper Co. Ltd.; Dec. 1920 to date, mech. engr., Three Rivers Pulp & Paper Co. in charge of engr'g office.

References: H. Longley, E. Brown, W. G. Matheson, D. Lewis, A. R. Roberts, E. A. Ryan, R. C. McCully.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

COMEAU—JULES, of Montreal, Que. Born at Montreal, March 16th, 1897; Educ., Civil Engineer, Laval Univ., 1919; 1918 (summer), dftsman, Price Bros., Kenogami, Que.; May 1919 to Jan. 1920, asst. engr., P. W. D., Quebec Govt.; Jan. 1920 to Jan. 1921, asst. res. engr., Price Bros., on constrn of a hydro power development at Chutes aux Galets, Que., in charge of all field works and estimates; At present asst. engr., Public Works & Labor, Bridge Branch, Quebec Govt.

References: C. N. Shanly, F. L. Darrell, J. M. H. Cimon, I. E. Vallee, C. C. Leluau, E. S. T. Lavigne.

CONIBEAR—WILLIAM ROY, of Niagara Falls, Ont. Born at Cornwall, Ont., April 1st 1896; 1912 (May-July), irrig. dept., C.P.R.; 1914-19, overseas; Sept. 1919 to June 1920 and Nov. 1920 to date, rodman, H.E.P.C., Niagara Falls.

References: A. C. D. Blanchard, F. W. Clark, C. H. McDougall, H. L. Bucke, N. Malloch.

HUGHES—BERNARD HOPE, of Ottawa, Ont. Born at London, England, Nov. 3rd, 1889; Educ., 2 yrs. S.P.S., Univ. of Toronto, 1914; 1910 and 12 (summers), rodman, City of Toronto Sewer Dept.; 1912, asst. engr., Winnipeg River Power Survey, Dept. of the Interior; 1913 (summer), rodman on constrn., C.P.R.; 1914-19, overseas, Can. Engrs.; May 1920 to date, instr'man, reclamation service, Dept. of the Interior.

References: W. R. Worthington, G. Phelps, W. M. Ogilvie, J. T. Johnston, F. S. Rutherford, T. Taylor, R. O. Wynne-Roberts.

IMBLEAU—TREFFLE H., of Renfrew, Ont. Born at Renfrew, Ont., Aug. 29th, 1895; Educ., B.Sc. (Mech. Eng.), Queen's Univ., 1919; Since May 1919, mech. engr., with the Ha. Ha. Bay Sulphite Co., Port Alfred, Que., and the Cie de Pulpe de Chicoutimi, Chandler, Que.

References: T. S. Scott, P. Gillespie, E. A. Stone, C. W. Burroughs.

PRINGLE—FRANK DUNBAR, of Hamilton, Ont. Born at Burlington, Ont., June 12th, 1889; Educ., B.Sc., Queen's Univ., 1917; 1909-10, blue printing and tracing, London Machine Tool Co.; 1910-12, dfting, Can. Westinghouse Co.; 1913 (Apr.-Sept.) city surveys and suburban work, J. W. Tyrrell & Co.; 1914 (Apr.-Sept.), levelling, C.N.R. Smiths Falls; 1915 (Apr.-Oct.), office, E. D. Smith & Son, Winona; 1916-17, Can. Engrs.; 1917-19, mech. branch, Can. Naval Service, Halifax; 1919 (Mar.-Sept.), Hamilton Harbor Commission; Sept. 1919 to date, munic. engr'g & city surveys, MacKay, MacKay & Perrie, Hamilton.

References: J. E. Hollaman, F. W. Paulin, T. S. Scott, E. R. Gray, H. S. Van Patter, W. B. Ford, E. A. Stone, J. W. Tyrrell.

SCOTT—ALLEN NYE, of Ottawa, Ont. Born at Ottawa, Feb. 9th, 1888; Educ., B.Sc., McGill Univ., 1912; 9 mos. shop experience; 1912-13, asst. engr., H.E.P.C. of Ontario, Ottawa; 1913-14, supt. of steel on ten story reinforced concrete bldg. for C. E. Deakin, Contractor, Montreal; 1914-15, asst. engr., H.E.P.C., Ottawa; 1915-19, Lieut. & Capt. Can. Engrs. Awarded M.C.; 1919 (Apr.-Dec.), design and supt. of constrn. of condensery bldg. at Russell, Ont., for Ottawa Dairy Co., Ltd.; Jan. 1920 to date, asst. engr. in charge of constrn. & install'n of mach. at six plants for manufacturing milk powder for Canadian Milk Products.

References: M. B. Atkinson, J. A. Ewart, J. Murphy, F. E. Bronson, A. A. Dion, J. E. Brown.

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The Construction of the Toronto-Hamilton Highway

A history of the project from plans to final slab, with details of operation and tables of costs.

H. S. Van Scoyoc, A.M.E.I.C.

Formerly chief engineer the Toronto-Hamilton Highway Commission, now consulting engineer the Toronto-Hamilton Highway Commission.

Read before Montreal Branch, The Engineering Institute of Canada, January 27th, 1921.

The purpose of this paper is to discuss in a rather intimate way some of the features connected with the construction of what is and, will probably continue to be the most important section of trunk highway in Canada. An endeavor will be made to include such engineering data as may admit of a broad application and to give in detail some construction costs which have not previously been made public. In order to avoid as far as may be possible a disjointed statement the subject matter will be presented under the following headings.—

Historical Data.
Organization.
Suggested Routes—Standard Sections—Tests.
Preliminary Estimates.
Construction West of the Etobicoke River.
Construction in York County.
Conclusion.

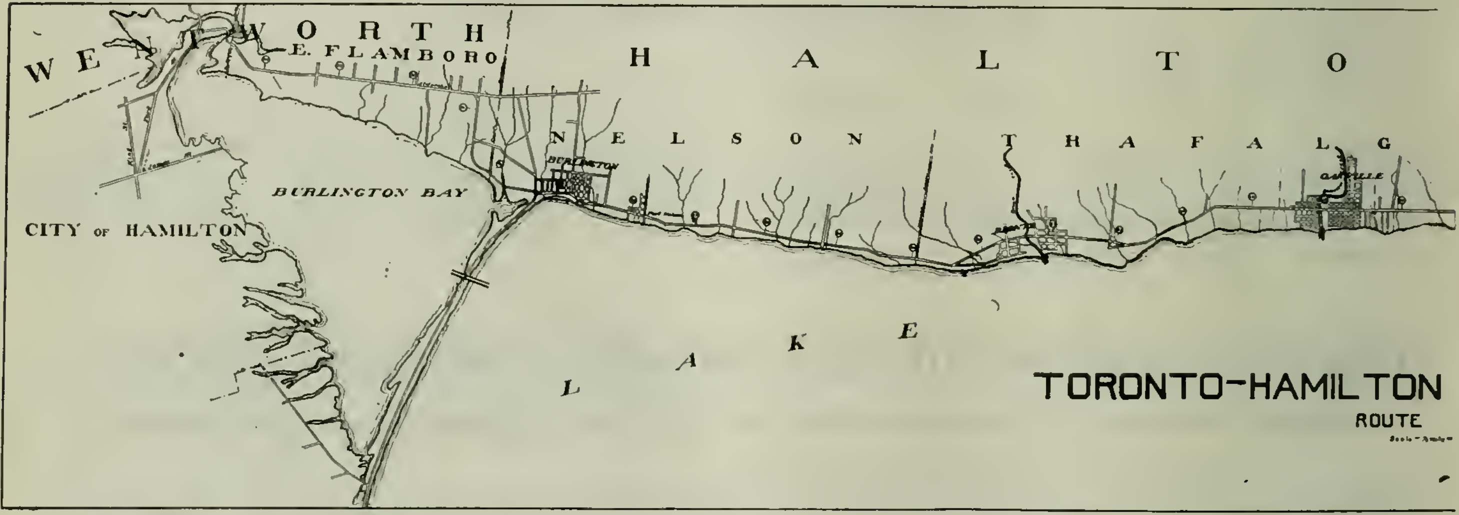
Historical Data

The first official record of what is now known as the Toronto and Hamilton Highway occurs in the Public Archives of Canada, series Q. Vol. 283, 1798. It reads—"It is ordered that roads be opened with bridges, between the Humber and the Credit and from the Credit to the head of the lake, the work to be done by the Queen's Rangers." The diary of the Provincial Land Surveyor, Augustus Jones, for May 19th, 1798, contains this entry.—"Saturday, 19th May 1798—Busy marking the most eligible ground for a road from the mouth of the Humber to a creek called Lamabinecouce. Struck it above the pond and marsh. Fine weather." Other subsequent entries tell of the additions to this first section. While a few stretches were improved from time to time no real effort towards a satisfactory Highway between Toronto and Hamilton was made until 1912. In that year W. D. Flatt, of the Township of Nelson, led a deputation which appeared before their township council. Subsequently representatives of all of the interested municipalities including Toronto and Hamilton agreed to support the proposition, and in 1913 a very large delegation waited upon the Government urging the necessity for a permanent highway. Assurance was given that the matter would be taken up seriously at the next session. A strong sentiment had been created for a highway and when serious unemployment occurred following the beginning of the war in August, 1914, a small group of men including Lieut.-Col. John A. Cooper, G. Frank Beer, Mark H. Irish and Geo. H. Gooderham in an endeavour to prevent soup kitchens memoralized the Government suggesting that work on the Highway be begun at once. The circular presented read as follows:—

We propose that the people of Ontario shall collectively lend their credit so that payment for the construction of a Concrete Roadway between the Cities of Toronto and Hamilton, via a route herein submitted, may be guaranteed and immediately proceeded with.

We submit that this project should have your support and the support and sanction of your colleagues because:—

1. It will give instant and practically continuous employment to thousands of men at the height of the present depression.
2. It will create for the Province a valuable asset at a price far below its cost in normal times and this with the approval of all labour interests.
3. It places no unbearable burden in taxation, the outlay being borne solely by the ultimate beneficiaries and equally distributed among them.
4. It is relief work of the most practical kind.



Petition to Ontario Government

To Doctor, The Honourable J. O. Réaume, M.P., Minister of Public Works, Province of Ontario, Legislative Buildings, Queen's Park, Toronto.

Sir: It is generally conceded that lack of employment during the next few months will produce poverty and suffering throughout the Province of Ontario, and particularly in manufacturing and largely populated centres.

That there will be notable response to calls for aid to charity, no one doubts, but there is a strong feeling that an effort should be made to relieve the situation by providing work, in contra-distinction to the distribution of alms, and arranging for its certain continuance by satisfactory financing, thus ensuring at least the necessities of life to many who would otherwise become a public charge.

In these circumstances, we venture to present for your consideration, and the consideration of your colleagues in the Cabinet, a plan looking towards this desirable end. In so doing we beg to assure you that the project has the hearty support of many influential residents in this Province, as evidenced by the financial arrangements later referred to.

The Route

We propose that the road shall be built over what is known as the "Lake Shore Route" for the following reasons:—

1. As the highway is to be of the most approved permanent construction, designed to carry unlimited loads, and intended for the economical transportation of freight, it should follow the lowest gradients. The Lake Shore Route does this.

2. Having secured the lowest gradients, it is desirable to pass through districts where the taxation will be distributed over the largest possible number of property owners. On the Lake Shore Route is found the greatest number of small holdings abutting upon the proposed highway or affected thereby.

The Construction

The road will be constructed of concrete, in the most approved and up-to-date manner similar to highways already laid in Wayne County, State of Michigan, and also in Sarnia, Ontario. It will be a 24-foot road, 16 feet of which will be of concrete bearing a 4 foot shoulder on each side. It will be designed with a view to accommodating fast and slow moving traffic at a minimum of upkeep per annum.

The Normal Cost

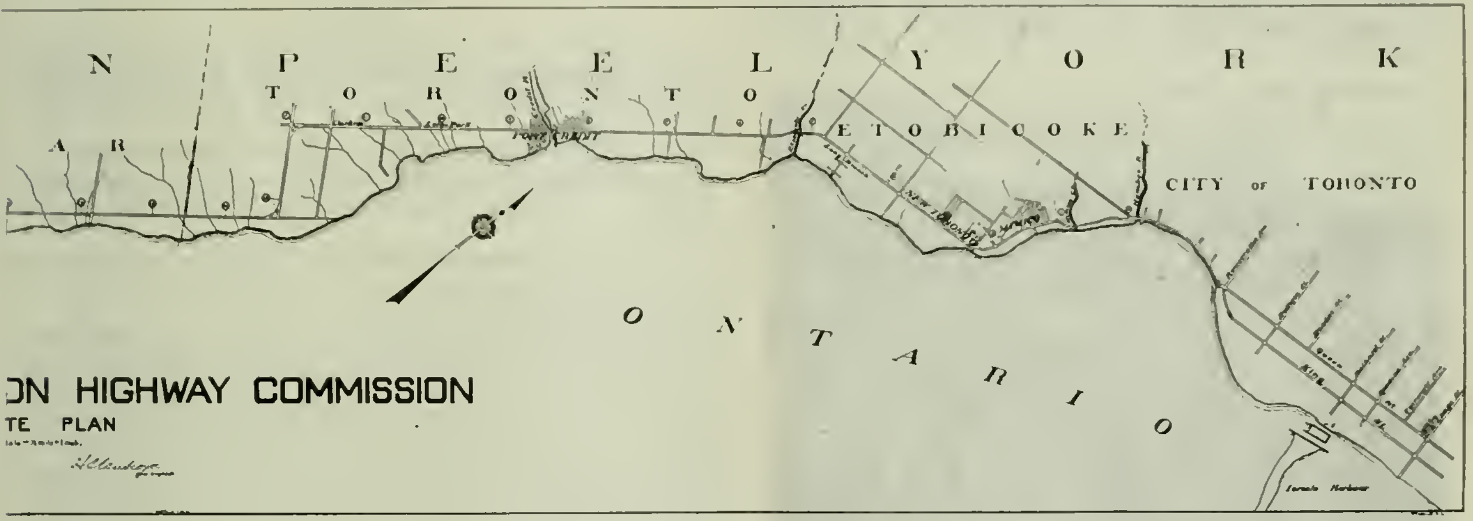
Material	Freight	Per sq. yd.	Per mile
Cement, $1.40 per bbl......	f.o.b. R.R. siding	45c.	$4,224.15
Sand, $1.30 c. yd..........	" " "	11c.	1,032.57
Trap stone, $2.40 c. yd.....	" " "	11c.	1,032.57
Base stone, $1.25 c. yd.....	" " "	16c.	1,501.92
Joints, .01 sq. yd..........			93.87
Total cost, material and freight...........		84c.	$7,885.08

Saving

You will appreciate the limited time at our disposal prevented even our enumerating the possible savings from different sources that might be confidently expected, but as a surety we submit the following as already in our hands:—

Cash contributions from cement interests...............	$ 25,000.00
" " stone interests.................	12,000.00
Reduction in cost of labour..........................	102,787.60
	$139,787.60

This will undoubtedly be substantially augmented in a supplementary report, should you favourably receive this suggestion, and we leave the point for your imagination, confidently believing that the railways and patriotic private means will still further reduce the general cost.



Labour at 20c. per Hour

	Per sq. yd.	Per mile
Labour on joints...........................	.01	$ 93.87
Mixing and placing concrete..................	.16	1,501.92
Rolling sub-grade and shaping shoulders......	.20	1,877.40
Grading and ditches........................	.10	938.70
Loading and teaming to job..................	.26	2,440.62
Total labour..........................	.73	$6,852.51
Materials, freight and labour..............	1.57	14,737.59

Total cost of road, approximately 40 miles, $589,503.60 without expense of management.

A reference to the above figures will at once acquaint you with the fact that the material for the project is to be supplied at cost or even below. This has the dual advantage of reducing the cost of construction and in preventing an increase in the number of unemployed.

Method of Payment

We should suggest that the road be paid for in a period of twenty years by the various parties interested by the issuance, after the interim financing hereinafter suggested has been completed of 5 per cent Sinking Fund Bonds, or similar securities, insuring the repayment to the Government of the money advanced through its credit during the interim period. The burdens to be borne will be as follows:—

City of Toronto already having agreed to this undertaking, the sum of..................................	$125,000.00
City of Hamilton, similarly............................	25,000.00
Provincial subsidy, $4,000. per mile.....................	160,000.00
Municipalities. $4,000. per mile.......................	160,000.00
Property taxation, frontage and area..................	143.000.00
	$613,000.00

The only item requiring explanation is that of the "property taxation" and our suggestion is that properties immediately abutting the roadway pay 1½c. per foot per annum; the next fifty acres in the rear 15c. per annum, and the next fifty acres in the rear 10c. per annum. This has been found to produce the sum above laid down on a 5 per cent twenty year basis. Whether the taxation on the property should be more is a matter for your consideration, but we submit that, as presented by us, it forms a most reasonable tax owing to the benefit to be derived from the properties served by the road, both in convenience and enhancement of value.

The Government should guarantee the maintenance for fifteen years, adding this to local taxes if thought desirable.

Immediate Financing

The permanent financing we have roughly outlined above. We now suggest that the permanent financing be postponed for a period of possibly five years, and that during this interim, evidence of security be issued by the Province bearing interest at 6 per cent per annum. (This evidence of security is, of course, for the judgment of yourself and your colleagues.)

A Section of the Highway in 1914.

Taking for granted that the security will carry with it the credit of the Province, we undertake to dispose of the amount necessary to construct the road, at par, and in addition to this we will place these securities in hands where we shall receive an undertaking that they will not be put upon the market, but will be held during the decided upon period. At the end of this period, we propose the method of permanent financing above outlined, which could then be arranged for, and would take care of the temporary flotation.

We believe that we should add that it is our intention to place this loan among a very limited number of citizens whom we believe are patriotic enough to enter into this project to relieve existing conditions.

Management

We urge that the construction of this Highway be placed in the hands of a Commission, composed of five members who shall be elected and appointed by the Lieutenant-Governor in Council, who shall have for his first object business efficiency in the personnel thereof. We urge that the appointees be of such high standing that the fullest powers may be confidently vested in them."

That the proposition did have careful and prompt consideration from the Government is shown first:—By a report submitted to The Honorable the Minister of Public Works under date of Sept. 2nd, 1914, by W. A. McLean, M.E.I.C., at that time Highway Commissioner, a copy of which is herein included, and second, by the fact that an Order-in-Council was made Sept. 17th, 1914, constituting the Toronto and Hamilton Highway Commission.

Preliminary Report

The report of Mr. McLean was as follows:

Sir:—

In pursuance of your request, I have read the statement respecting the Lake Shore Road, presented by Messrs. Gooderham & Irish, and would respectfully advise as follows:—

The Route

The Lake Shore Road should be selected for paving for the reasons stated, with the proviso that provision be made in Toronto Township for a deviation to avoid a series of hills; this, I understand, can be arranged.

In selecting a route, the question is not — which shall be a good road?— for Dundas Street, the Middle Road and the Lake Shore Road, should all, in the near future, be substantially constructed as good roads.

The present consideration is — which shall be the **paved road** to accommodate fast automobile and heavy truck traffic between the two cities of Toronto and Hamilton?

From a careful consideration of all conditions I am strongly of the opinion that the Lake Shore Road will under any circumstances receive the most severe traffic of all kinds; that if a pavement were constructed on the Middle Road, or Dundas Street, and an ordinary macadam on the Lake Shore Road, the Lake Shore Road would still attract the greatest amount of fast traffic, such as a macadam would not support, and the result would be a heavy outlay for maintenance along that road. A pavement on the Lake Shore Road and macadam on the other roads considered, would undoubtedly prove the most economical arrangement.

The Construction

The construction proposed should be subject to careful consideration. The roads of Wayne County are built of a one-course mixture, using clean washed gravel.

The proposal in the present instance is to construct a two-course pavement using limestone for the base and trap rock for the surface. The method proposed is not as safe a type of construction as that followed in Wayne County or Sarnia but may become necessary upon a more careful consideration of cost.

Normal Cost

The estimate of normal cost is probably low and might be expected to amount to $18,000 per mile. As the length to be constructed is nearly 36 miles the total cost might be estimated at $650,000 exclusive of culverts and bridges.

Saving

The estimated saving is based upon cash contributions and reduction in the cost of labour which are wholly subject to the efforts of the petitioners.

Method of Payment

The method of payment is a reasonable approximation of what might, after careful consideration, be reached. I am of the opinion, however, that the City of Toronto, in particular, should contribute a greater amount to the cost of this road; and also that a larger amount might be collected as a direct property tax. The cities of Toronto and Hamilton have, however, each offered to contribute the respective sums stated by the petitioners. With respect to the property tax, I am attaching a sketch which will indicate more fully their suggestion.

Immediate Financing

The method of immediate financing was one which the Highway Commission did not consider fully, but which was realized in such cases as the Lake Shore Road, to offer some difficulty. The proposal of the petitioners, however, if satisfactory security is given, would form a convenient solution in the present instance.

Management

The proposed system of management is in keeping with the views of the Highway Commission with respect to interurban roads. It was suggested that the control of the road should be vested in a Board of Trustees for construction and possibly for subsequent control for a term of years. It was believed, however, that some representation should be given to the various municipalities interested.

Further Consideration

Legislation would be necessary but so far as information is before the writer, I see no reason why this might not reasonably be guaranteed.

The several municipalities have all asked for the construction of such a highway; its urgent need is recognized; and the property-owners have petitioned for its construction, offering to pay the proposed tax of 1½c. per foot frontage for a term of 30 years.

If the term were reduced, the rate per foot frontage might reasonably be increased. The property immediately fronting on the road will in the great majority of cases be readily saleable for residential purposes and market gardens. Farm owners would in this way — in nearly all cases — release themselves from the frontage tax and would bear only the area tax for the suggested term.

The season is rapidly advancing and concrete cannot be laid in wet or freezing weather. Grading, however, could and should in several cases be carried out this fall, and such could be done to place material on the ground, thereby keeping the quarries in operation.

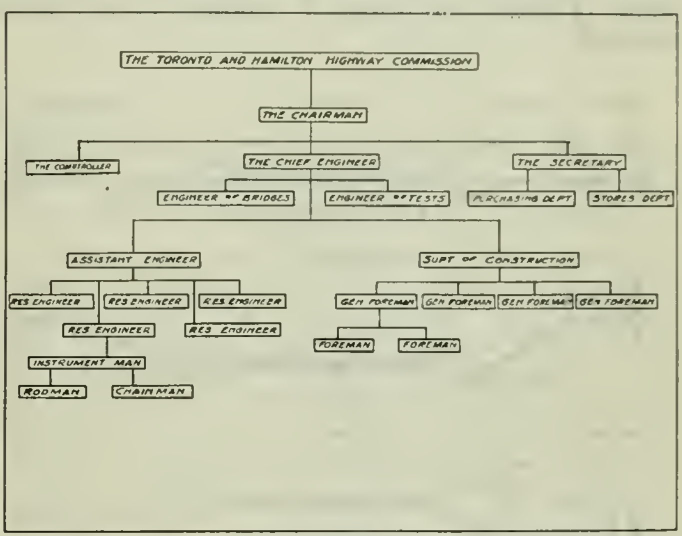
The survey of this road is completed. It is staked for construction and plans could be quickly furnished.

I have the honour to be, Sir,
Yours respectfully,
W. A. McLean, Commissioner.

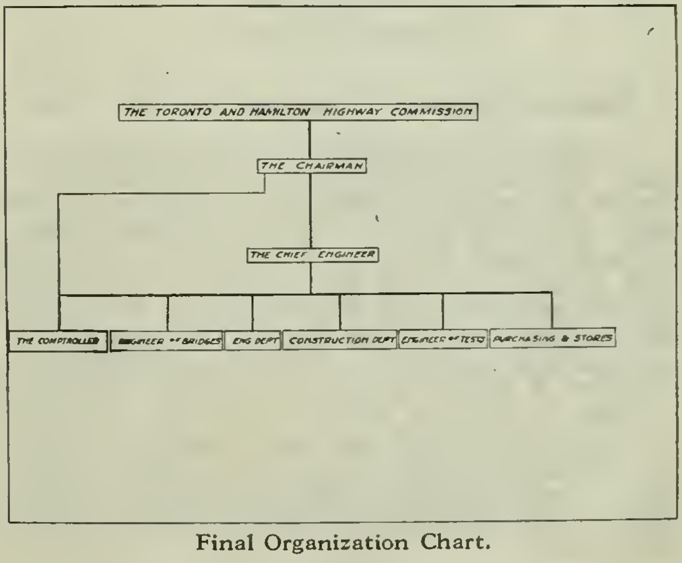
Organization

The Toronto and Hamilton Highway Commission originally was composed of George H. Gooderham, Toronto, G. Frank Beer, Toronto, T. W. Jutten, Hamilton, Maxwell C. Smith, Burlington, and Cecil G. Marlatt, Oakville. Mr. Marlatt was unable to act and his place was taken by W. S. Davis, Oakville, on Sept. 23rd. On Oct. 9th, Hugh Bertram, Vinemount; and Reuben Lush, Clarkson were added. The Commission has remained intact to the present time, the further addition of Thomas Griffith being made Jan. 1920. Geo. H. Gooderham was appointed chairman and the Commission was advised on Oct. 16th, 1914 that if agreements could be obtained with the cities of Toronto and Hamilton work could be proceeded with. The agreement with the City of Toronto was received Oct. 26th and with Hamilton on Oct. 27th. The first employee of the Commission was the writer, who reported as chief engineer, Nov. 4th, 1914. The first instructions were to get actual construction under way as quickly as possible; the first gang was at work on Nov. 8th.

The Toronto and Hamilton highway Commission occupies a unique position with regard to highway construction in Ontario as it was created in the interim that occurred between the old Good Roads Act and the new legislation which carried into effect the recommendations of the special Highway Commission. For this reason it was more self-dependent than would otherwise have been the case. One of the first things done by the Commission was to appoint a firm of chartered accountants to prepare a suitable form of organization as well as to make what amounted to a continuous auditing of the books.

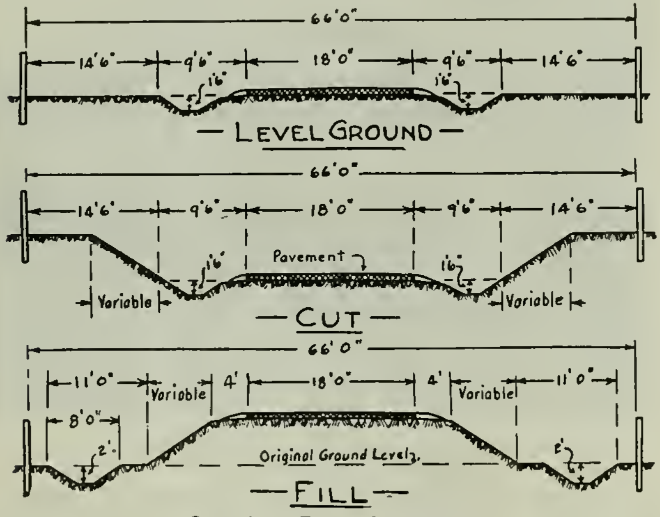


Original Organization Chart.



Final Organization Chart.

The one condition laid on the chief engineer in the employing of assistants was that only men living in those municipalities which were directly contributing to the cost of the highway should be engaged. With the lack of employment then existing there was no difficulty in securing competent men but it was impossible to find men experienced in constructing concrete roads and it was not possible to start with that esprit de corps which might have been secured if the staff had been made up largely of men who had previously worked together in one organization. While the total number of engineering positions available did not exceed thirty the number of applicants was more than three hundred. This made it possible to select men of an unusually high standard. Without exception the engineering staff was of British birth or training and with very few exceptions were student, junior or corporate members of *The Engineering Institute of Canada*. Many of the men in the Construction Department had had engineering training. The Toronto, Hamilton Highway was constructed largely as an engineer's job and the profession must receive praise or blame, whichever is merited by the results obtained.



Standard Road Sections.

Suggested Routes — Standard Sections — Test

In general the Highway followed an existing roadway. The final location with the diversions made and the various deviations suggested are shown on the route map. The right of way is 66 feet in width except in the most easterly section where it is hoped to eventually have a right of way 86 feet in width. The sub-grade has a minimum width of 26 feet in fill and 30 feet in cut. The original plans of the Commission provided for a concrete roadway 16 feet in width with broken stone shoulders 4 feet in width on either side. Before construction was begun, however, the width of concrete was changed to 18 feet and earth shoulders substituted for broken stone. Subsequently the width of concrete on the section nearest Toronto was increased to 24 feet. The various standard sections used are shown on Drawings Nos. 5 and 6.

As work was begun very late in the fall, the winter months were available for the investigation of possible sources of supply for suitable fine and coarse aggregates. A Department of Tests was organized and through the kindness of the University of Toronto and the Provincial Department of Highways the laboratories at the University were placed at the disposal of the Commission. Samples of fine aggregate were collected from more than forty sources with full information as to accessibility, quantity, price, etc. A summary of the results is shown in the following table:

Practically all the sands were high in limestone content, but a number of them gave very excellent strengths and consisted of hard tough particles.

Similarly, samples were taken from eleven stone quarries, one of which was trap, the others being limestone. Laboratory tests were made with the results shown in the table below.

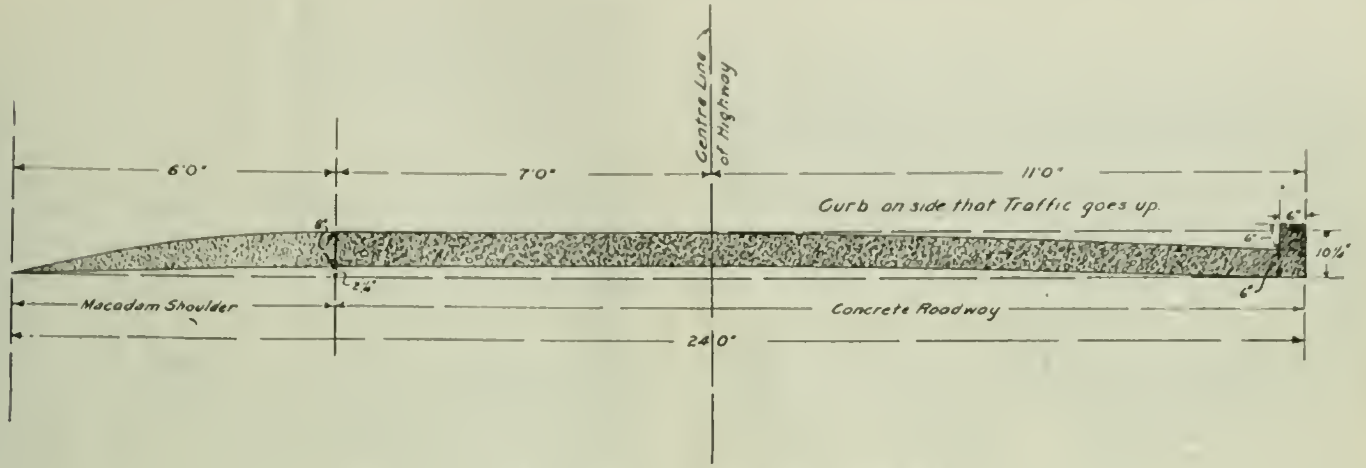
Samples from four of the quarries gave a French coefficient of wear of nine or more and were considered satisfactory as far as quality was concerned.

Specifications were prepared both for fine and coarse aggregates and tenders invited where the tests showed suitable materials could reasonably be expected. As stone was purchased by the ton but the concrete measured by the cubic yard the specific gravity of the stone was considered in comparing prices. Experiments showed these results.

Sample	Specific gravity	Tons per cu. yd.
2	2.72	1.26
3	3.02	1.40
7	2.67	1.24
9	2.77	1.28
10	2.71	1.255

In order to avoid difficulties on the work, practically all cement, fine, and coarse aggregates were tested at the point of origin with occasional check tests made on materials delivered on the work. As shipments were made in comparatively large quantities this method was quite economical and led to practically no rejections on the work.

The mixture of concrete decided upon for the road surface was one part of cement to one and one half parts of fine aggregate to three parts of coarse aggregate proportioned by volume. When contracts had been made for the materials and shipments received compression test pieces were made up in the laboratory. Test cubes were also taken from the concrete as it was being placed in the roadway. As an evidence of the quality of the concrete secured some of the results are given in the following table:



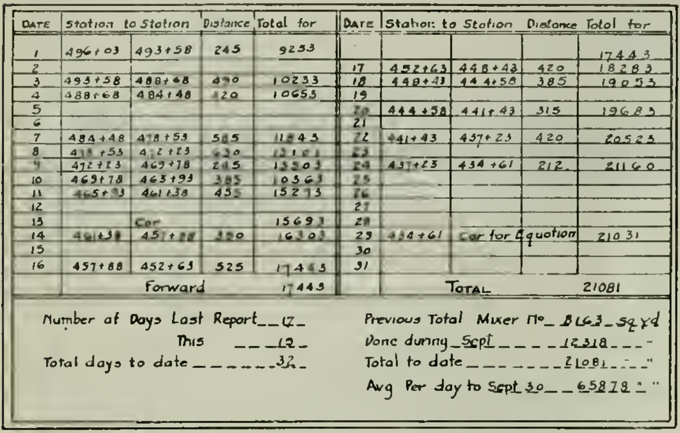
Plan showing Proposed Roadway Section on Grades of 4% or over.

Tests of Fine Aggregate

1-3 Mix

Sample No.	Sieve Test		% Silt	Tensile Strength			Remarks	Sample No.	Sieve Test		% Silt
	%50Mesh	%100Mesh		3 days	7 days	28 days			% 50 Mesh	%100Mesh	
1	11.5	1.8	0.9	275	454	603	4½ Cu. yd. 0.50 unscreened.	19	50.3	12.0	3.2
2	14.2	3.7	2.0	265	385	558	1½ Cu. yd. 0.50 "	20	33.1	9.5	3.0
3	16.1	1.9	0.6	118	203	348		21	18.1	2.5	0.8
4	9.2	1.1	1.7	228	303	433	1½ Cu. yd. 0.50 pit run.....	22	12.4	1.1	1.0
5	4.6	1.6	1.3	274	292	510	.20¢. Ton at pit screened....	23	1.6	0.8	1.6
6	10.3	2.2	2.6	250	243	382	" " " "	24	10.6	2.8	1.8
7	3.1	0.9	1.2	123	240	378	Sell pit for $5,000..........	25	58.3	2.6	
8	3.0	0.7	1.4	271	361	467		26	9.7	3.7	8.5
9	7.7	1.8	2.8	303	436	431		27	17.0	1.5	1.4
10	13.4	3.5	2.0	210	330	436	Broken at 34 days..........	28	10.2	4.1	2.7
11	9.8	3.4	1.1	205	256			29	10.7	4.4	4.2
12	5.2	0.9	1.4	226	343	566	Pit run 1½ Cu. yd. 0.50 at pit	30	63.2	19.2	2.0
13	19.6	4.1	2.7	186	291	433		31	11.2	4.0	5.2
14	3.3	2.5		265				32	9.2	4.9	8.7
15a	7.3	1.3	0.9	190	311			33a	1.3	0.6	2.4
b	4.6	0.5		165	333			b	4.8	1.6	1.5
16	23.5	11.7	9.1	200	311	455	60¢. F.O.B. Pit Cu. yd......	34	3.6	0.7	1.9
17	20.0	1.5	0.15	126	221			35	32.4	7.0	7.0
18	18.5	11.2		278	436	620		36	38.0	8.3	
								37	4.2	0.7	0.4
Standard Ottawa Sand											
				156	268	380		38a	28.3	7.3	4.9
								b	11.7	0.9	1.7
Neat Cement				24 hr.							
				225	616	666		c	36.7	2.4	
								39	35.1	30.1	

Office of the Chief Engineer, Toronto, April 7th. 1915 43—6—1

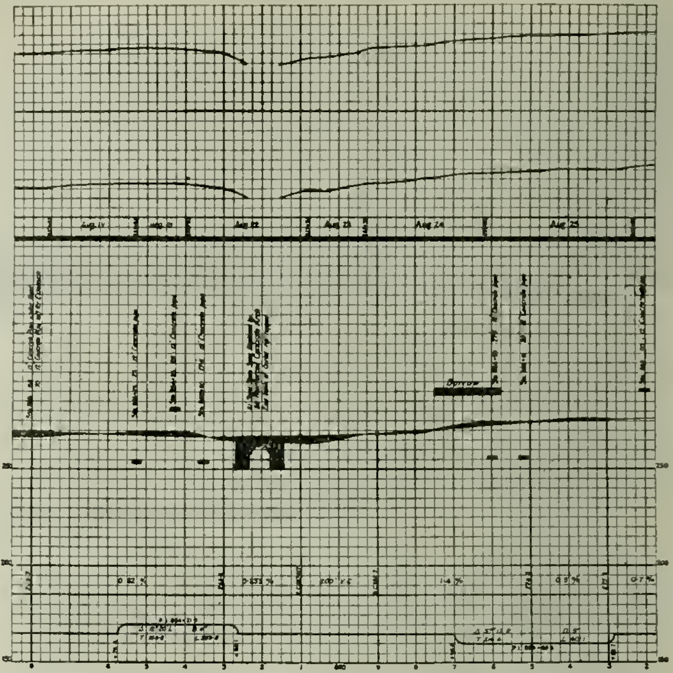


DATE	Station	to Station	Distance	Total for	DATE	Station	to Station	Distance	Total for
1	496+03	493+58	245	9253					17443
2					17	452+63	448+43	420	18283
3	493+58	488+68	490	10233	18	448+43	444+58	385	19053
4	488+68	484+48	420	10653	19				
5					20	444+58	441+43	315	19683
6					21				
7	484+48	478+53	595	11843	22	441+43	437+23	420	20523
8	478+53	472+23	630	[illegible]	23				
9	472+23	469+78	245	13503	24	437+23	434+61	212.	21160
10	469+78	465+93	385	10363	25				
11	465+93	461+38	455	15273	26				
12					27				
13		Cor		15693	28				
14	461+38	457+88	350	16303	29	434+61	Cor for Equation		21031
15					30				
16	457+88	452+63	525	17443	31				
	Forward			17443		Total			21081

Number of Days Last Report __17_
This ___12_
Total days to date _______32_

Previous Total Mixer No_ 8763_sq yd
Done during_Sept_____12318___"
Total to date_________21081___"
Avg Per day to Sept 30___658.78 ""

Record of Concrete Road Placed



Typical Profile

Tests of Coarse Aggregate

Sample	Tested by	Specific gravity	Absorb'n.	Per cent wear	French coeff.	Toughness	Hardness	Cement'n.
1	C. a	2.65	0.167	8.29	4.90	7.00		
	b	2.62	0.54	8.29	4.80			
	c			6.80	5.90			
2	C. a	2.74	0.102	4.36	9.00	5.00		
	b	2.71	0.104	3.30	12.10	5.00		
	T. a	2.71	0.130	6.10	6.50	5.20		19.2
	b					5.50		
3	C.	3.06	0.09	2.30	17.30	22.00		
	W. a	3.00	0.19	2.90	13.60	13.00	17.90	
	b	3.00	0.31			24.00	18.30	
4	C.	2.69	0.304	5.00	8.00	5.00		
5	C.	2.79	0.05	5.40	7.40	6.00		
6	C.	2.68	0.23	4.70	8.50	6.00		
7	C.	2.68	0.41	4.06	9.80	10.30		
	W. a		0.93	3.00	13.20	12.00		
	b	2.65	0.93			12.00	18.80	
8	C.	2.77	0.76	5.10	7.80	9.30		
9	C.	2.76	0.68	3.80	10.50	11.30		
	W. a	2.80	0.81			10.00	14.30	
	b	2.75	0.61			10.00	15.80	
	c	2.75	0.65	3.80	10.40	13.00	15.90	
	d	2.75	0.93	3.60	11.20	11.00	15.40	
	e	2.80	1.17	2.90	13.70	14.00	15.80	
	f		0.31			12.00		
	g		0.61	2.90	13.70	10.00		
	h		1.17			14.00		
10	C.	2.71	0.48	3.70	10.80	10.00		
	T.	2.70	0.53	5.41	7.39	11.00		
11	C.	2.69	0.106	5.10	7.80	7.00		

Office of the chief engineer, Toronto, March 31, 1915

43—6

Reference

Tested By
C. Toronto Hamilton Highway Commission, H. E. Davis
T. University of Toronto
W. Washington.

....Chief engineer

Compression Tests

Test specimens made in laborntory Sand No. 1 used for all tests

Series No.	Mix	28 days	3 months	Remarks
C. 1	1–½–3 By vol.	3280 3065 3480 Average 3275	3625 3410 Average 3533	Crusher run stone 2″ ring retained on ¼″ ring
C. 2	1–½–3 By vol.	3935 3990 3850 3925	3818 4980 4399	Crusher run stone all pass 1½″ ring retained on ¼″ ring
C. 3	1–1½–3 By vol.	4700 4400 4550	4755 5280 5017	Crusher run stone all pass 1″ ring retained on ¼″ ring
C. 3-5	1–2–4 By vol.	3245 3440 3348	3960 4040 4000	Crusher run stone pass 2″ ring retained on ¼″ ring
C. 6	1–2–4 By vol.	3840 3845 3842	5375 5180 5278	Crusher run stone pass 1½″ ring retained on ¼″ ring
C. 7	1–2–4 By vol.	2980 3020 3000	3490 3358 3924	Crusher run stone pass 1″ ring retained on ¼″ ring

Series No.	Mix	% Water	Sand	Stone	28 day	3 month	6 month	Remarks
C. 8	1-1½-3	7%	No. 5	Dundas	3358 3360 Aver. 3359	4660 3580 4120	5555	6 month test over capacity of machine
C. 9	"	"	No. 1	"	2910 2525 2718	3835 4140 3987	5555	
C. 10	"	7.8%	No. 4	"	1942 1640 1791	3060 3200 3130	4480 4361 4420	
C. 11	"	7%	No. 3	"	2779 2890 2835	3145 3565 3355	4962 4425 4693	
C. 12	"	8%	No. 2	"	2840 2590 2715	2900 2880 2890	2805 4272 3538	

X-C.

Result of Tests.

6″ Cubes made at Intervals along the Highway

Six inch cubes were made of the materials as it came from the mixer placed alongside the road and entirely covered with earth springled at the same time as the road and covering taken off nineteen days later shipped to the laboratory and tested at twenty-one and twenty-eight days.

	21 days	28 days
Sand No. 1	3302	3822
Sand No. 2	4052	4685
Sand No. 3	3037	3650
Sand No. 4	3720	4288

Preliminary Estimates

As previously stated, work on the Highway was under way four days after the chief engineer reported, before the names of all of the members of the Commission were known to him and after only one trip over the proposed route. A survey had been made by the Department of Highways and plans based on it were used for the earlier work. A statement of cost was included in the circular submitted to the Government (See page 161) Certain references were made to these figures in the report made by the Highway Commission.

By no stretch of the imagination could they be considered as a preliminary estimate of cost. They were made without knowledge even of the route traversed. They provided only $938.70 per mile for grading and drainage and pre-supposed that the Commission would operate directly under the Department of Highways so no provision was made for the overhead expenses of management, engineering, etc. Nothing whatsoever was allowed for bridges and culverts although the road was to parallel Lake Ontario and is in sight of the Lake for almost its entire extent, a location likely to give a maximum of expense for drainage structures. Under ordinary conditions no work should have been undertaken until careful preliminary estimates had been completed. As relief work, however, no delay was justifiable. The securing of data for estimates was begun at once, but the engineering staff had to keep ahead of the construction force before everything else and it was not until April 10th, 1915 that a preliminary estimate of cost was presented to the Commission. This estimate included only thirty-one miles of the Highway as up to that time no decision had been reached regarding the section nearest Toronto, nor was there definite knowledge as to the route that would be followed at the Hamilton end. It included the 31 miles westerly from the western boundary of New Toronto. The summary sheet of the grading estimate was as shown below.

Preliminary Estimate of Grading

Item	Total	Unit	Unit cost	Total cost
			$	$
Clearing..............	14.72	Acres	50.00	736.00
Grubbing.............	7.23	"	200.00	1,446.00
Sodding...............	151,770.	Sq. yds.	.03	4,553.10
Excavation...........	161,794.	Cu. yds.	.40	64,717.60
" ditches.....	118,520.	"	.35	41,482.00
" borrow.....	12,000.	"	.35	4,200.00
Fill..................	204,810.	"		
Drainage course.......	2,267.	"	2.00	4,534.00
Scarifying............	209,999.	Sq. yds.	.15	31,499.85
Fine grading..........	327,563.	"	.01	3,275.63
Rolling...............	474,907.	"	.01	4,749.07
12″ weep tile..........	12,150.	Lin. ft.	.25	3,037.50
12″ tile-approaches....	10,440.	"	.65	6,786.00
18″ tile-approaches....	575.	"	1.00	575.00
24″ tile-approaches....	45.	"	1.50	67.50
30″ tile-approaches....	25.	"	1.50	37.50
Backfill for tile........	3,209.	Cu. yds.	.25	802.25
Excn. con. cul. & pipe..	2,474.	"	2.00	4,948.00
Backfill " " ..	665.	"	.25	116.25
Rip rap..............	299.8	"	2.50	749.50
Concrete culverts......	1,470.	"	7.25	10,657.50
" culverts ext'd.	1,455.	"	9.00	13,095.00
" reinforcement.	56,153.	Lbs.	.05	2,807.65
Concrete pipe 12″.....	50.	Lin. ft.	.65	32.50
" " 18″.....	1,555.	"	1.25	1,943.75
" " 24″.....	605.	"	1.50	907.50
" " 30″.....	105.	"	2.00	210.00
Excn. con. culvt. & pipe (easier than ordinary)	2,299.	Cu. yds.	1.00	2,299.00
Backfill conc. culvt. & pipe.............. (more expensive than ordinary)	1,107.	"	1.00	1,107.00
				$211,422.65

The cost in the various sections is shown in Table.

Preliminary Estimate of Grading
April 10th, 1915

Section	Mile From	To	Dist. in miles	Estimated cost of grading	Average cost per mile	Percentage of total	
						cost	mileage
A	0	9.60	9.60	$78,836.20	$8,212.21	37	31.0
B	9.60	18.30	8.70	55,273.80	6,353.31	26	28.0
C	18.30	25.56	7.26	43,871.60	6,042.92	21	23.4
D	25.56	31.00	5.44	53,441.05	6,147.24	16	17.6
Total.......	....		31.00	$211,422.65	$6,820.08	100	100.0

An estimate of the probable cost per mile of finished paving made at this time was as follows:—

Preliminary Estimate as of April 10th, 1915

Concrete pavement 18 feet in width with earth shoulders three feet in width on either side.

Cost per Mile

Grading (details in table)..............................	$ 6,820.00
10,560 sq. yds. of concrete @ $1.40 per sq. yd. say......	14,784.00
1500 sq. yds. reinforced @ $0.07 per sq. yd. say.........	105.00
Earth shoulders 600 cu. yds. @ $0.25..................	150.00
	$21,859.00
Engineering and general expenses. 6% say............	1,311.54
Contingencies..................10% say............	2,317.05
Total..	$25,487.59
Cost for 36 miles, say................................	$917,553.24

Before these estimates were submitted, however, the Legislature had passed the Toronto and Hamilton Highway Commission Act, 1915, which was based on a total cost of $600,000.00. When the estimates were laid before the Commission and informally discussed, the unanimous decision was to endeavour to construct a highway first class in every way rather than to attempt to limit the expenditure to $600,000.00.

Construction West of the Etobicoke River

In order to provide as much work as possible for the unemployed, grading was carried on through the winter months. Only needy men with families were hired. Many of them were unaccustomed to pick and shovel work. Before a gang was hardened to the work it was replaced by a new draft in an effort to aid as many needy families as possible. Most of the work done was on those sections where the grading was heaviest. The ground moved was frozen. Dynamite was used constantly. Teams ploughed day and night in order to offset as far as possible the effects of the frost. At the end of March, 1915 our progress report shown that about

62,000 cubic yards of earth had been moved at a cost of 65 cents per cubic yard. This represented about 30% of the entire yardage exclusive of York County and about 95% of the heavy grading work. It was the material that could have been most economically handled under proper conditions. The cost was three times that of the heavy grading done during the summer months but about 300 men were given employment during the winter and a maximum of slightly more than 1,000 during the summer. 3,983 men applied to the Commission for work up to the end of 1915. 3,430, all British subjects, had been given employment and nearly 300 of the unskilled labourers enlisted in the Canadian Forces. They were real men and they appreciated the assistance that had been given them.

On account of delays in yard arrangements, the laying of the concrete paving was not begun until July 21st, 1915 and an unusually wet season prevented continuous work but by the end of the Commission's year, October 31st, 1915, a total of 131,519 sq. yds. had been completed and the quantities of materials used and the costs are shown in the table.

Details Concrete Paving Cost

Total quantity of paving laid to October 31st, 1915....131,519 sq. yds.

Materials required.				Cost per sq. yd.
Cement,	205,304 bags, — 51,326 barrels @ $1.35....................		$71,856.40	$0.526
Sand,	16,093 tons @ 0.88...........		14,161.84	0.107
Stone,	29,818 " @ 0.95...........		28,327.10	0.215
Joints,	per 100 lineal ft. of material @ $2.39....................			0.006
Labour.				
Joints, mixing and placing....			$25,488.65	$0.190
Loading and teaming to job,				
Hauling................		$13,383.98		
Unloading	$1,241.26 3,074.12 1,382.46			
	5,697.84	5,697.84		
Track laying............		7,755.18		
Track maintenance......		3,371.69	30,208.69	0.229
Total...........................				$1.273

These figures do not include an allowance for plant depreciation and are exclusive of costs for management or engineering. The laying of concrete continued into November, the total yardage for the year being 162,841 sq. yds. Almost all of the heavy grading West of the Etobicoke was completed by the end of the year.

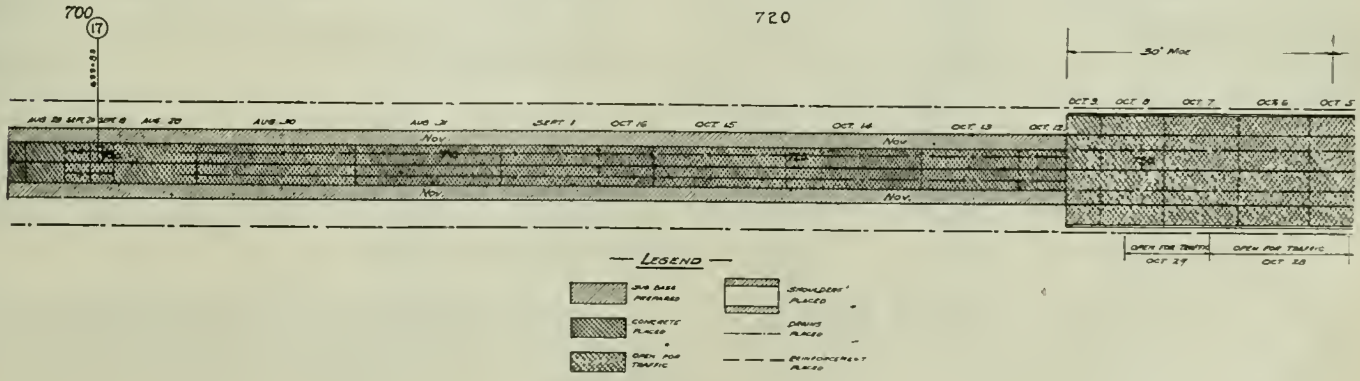
Construction East of the Etobicoke River

When the Provincial Legislature met in 1916 it was necessary to amend the Act passed in 1915 in order to provide for the increased cost shown by the Commission's estimates. The entire basis of financing was changed, the excess cost over a fixed sum being borne by the government. Revised estimates were prepared and presented.

In the estimate presented to the Government on April 10th, 1916, provision was made for the completion of a concrete roadway from the West end of the then existing Dollarway pavement in Mimico to the city limits at Hamilton. No provision was made for bridges at Mimico Creek, Etobicoke River, Oakville, Bronte or the entrance to Hamilton or for the paving with concrete of the Bridge approaches.

The expenditure of the Commission to this date was...........................		$638,734.85
The estimated cost of the work in York County was.........................		92,999.00
The estimated cost of the work west of the Etobicoke was......................		299,129.30
Total..................		$1,030,863.15
Credits for special work in York County not chargeable to Commission...............	$15,010.00	
Credits for special work west of the Etobicoke not chargeable to Commission........	$18,000.00	$33,010.00
Total estimated cost of Highway to Commission was........		$997,853.15

The detailed estimates of the work to complete were as follows:—



Graphical Progress Record

Estimate of cost of completion from the Etobicoke Creek Easterly in York County

Quantity	Unit	Item	Unit cost	Total
1	Acre	Clearing	$60.00	$ 60.00
0.5	Acre	Grubbing	200.00	100.00
35000	Sq. yards	Sodding	.03	1,050.00
13000	Cu. yards	Excavation	.50	6,500.00
17000	Sq. yards	Scarifying	.01	170.00
29600	Sq. yards	Fine grading	.03	888.00
50000	Sq. yards	Rolling	.01½	750.00
5700	Cu. yards	Pipe excavation	.75c.	4,275.00
		Concrete pipe 12'', 18''–24''		700.00
20800	Lin. feet	Vitrified pipe—12''	.15c.	3,120.00
7500	Cu. yards	Gravel backfilling	1.00	7,500.00
400	Cu. yards	Earth backfilling	.25	100.00
100	Cu. yards	Culvert foundation excavation	.75	75.00
200	Cu. yards	Concrete culvert	$9.00	1,800.00
5000	Pounds	Reinforcement	.04	200.00
200	Cu. yards	Backfill	.30	60.00
29600	Sq. yards	Concrete pavement	1.40	41,440.00
3200	Sq. yards	Macadam	.80	2,560.00
15000	Sq. yards	Reinforcement	.05	750.00
16400	Lin. feet	Shoulder 6' stone	.35	5,740.00
		Extra work and moving Radial siding		2,500.00
		Contingencies, superintendence and engineering		12,645.00
				$ 92,999.00

Estimate of cost of completion from the Etobicoke Creek Westerly to the City limits of Hamilton on the present Plaine Road

Quantity	Unit	Item	Unit cost	Total
0.8	Acre	Clearing	$60.00	$ 48.00
0.5	Acre	Grubbing	60.00	30.00
5600	Sq. yards	Sodding	0.03	168.00
27000	Cu. yards	Excavation	0.50	13,500.00
300	Cu. yards	Drainage course	0.75	225.00
16600	Sq. yards	Scarifying	0.01	166.00
158620	Sq. yards	Fine grading	0.03	4,758.60
158620	Sq. yards	Rolling	0.01	1,586.20
980	Cu. yards	Foundation excavation	0.65	637.00
80	Lin. feet	Con. pipe—18''	1.00	320.00
120	Lin. feet	Con. pipe—30''	2.00	
1500	Lin. feet	Vitrified pipe—12''	0.15	662.50
1250	Lin. feet	" " 18''	0.35	
260	Cu. yards	Gravel backfill	0.75	195.00
1000	Cu. yards	Earth backfill	0.25	250.00
760	Lin. feet	Con. culvert rlg	1.00	760.00
159220	Sq. yards	Con. paving	1.40	222,908.00
16500	Cu. yards	Shoulder	0.25	4,125.00
21000	Lin. feet	Protection rail	0.15	3,150.00
10800	Sq. yards	Macadam paving	0.80	8,640.00
		Contingencies — engineering, etc.		37,000.00
				$299,129.30

By the provisions of the Toronto, Hamilton Highway Act, 1916, the financing was arranged for on the following basis.

City of Toronto	$250,000.00
City of Hamilton	50,000.00
Municipalities traversed by the Highway by direct tax	216,000.00
Municipalities traversed by the Highway by local assessment an amount not exceeding $4,000.00 per mile — about	144,000.00
Provincial Government balance of cost not exceeding 40% of $920,000	368,000.00
	$1,028,000.00

By February 28th, 1917, the construction work West of the Etobicoke was practically completed and a summarized statement of cost on this section shows expenditures as follows:—

Cost of section West of Etobicoke

General expenses	$ 25,441.17	2.6%	
Engineering	41,914.25	4.2	
Plant	22,438.03	2.3	
Right of way and surveys	17,189.41	1.7	
Legal	2,376.46	0.2	
Purchasing and inspection	10,183.17	1.4	
Stores	23,085.65	2.3	
Camps	50,715.82	5.2	
Grading	186,346.17	19.0	
Bridges, culverts, guard rail	55,756.11	5.7	
Drainage	45,299.80	4.7	80.1
Macadam shoulders, etc	42,723.55	4.3	
Concrete roadway	454,004.07	46.4	
Total	$977,473.66	100.0%	

Detailed figures as to quantities and costs for labor are shown on the returns made on the division engineers summary sheets for February 28th, 1917, which were as follows.—

Detailed Quantities and Labour Costs

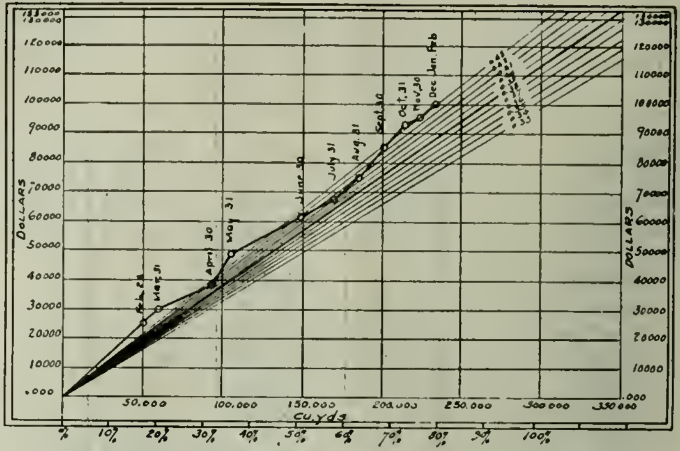
Description of Work	Unit	Quantities	Total cost	Average unit cost
Clearing	Acre	16.44	1,035.20	63.63
Close cutting	Acre	0.70	59.70	85.29
Grubbing	Acre	8.48	624.11	73.69
Sodding	Sq. yd.	322,259.00	8,803.52	0.0273
Excavation				
Solid rock	Cu. yd.	1,811.00		
Loose rock	Cu. yd.	180.00		
Hard pan	Cu. yd.	53,802.00		
Earth	Cu. yd.	193,888.00		
Borrow	Cu. yd.	132.00		
Extra haul	Cu. yd.	120,364.00		
Cost			119,834.44	0.48
Scarifying	Sq. yd.	144,569.00	1,623.85	0.0114
Rolling				
Sub grade	Sq. yd.	374,648.00	5,890.05	0.0135
Fills	Sq. yd.	62,265.00		
Fine grading				
Earth	Sq. yd.	208,857.00	18,752.14	0.055
Hard pan	Sq. yd.	130,654.00		
Drainage course				
Crushed stone	Cu. yd.	1,397.00	1,606.55	1.16
Gravel	Cu. yd.	2,164.00	1,251.13	0.58
Transportation team				
Train	Ton mile	2,882.00	534.43	0.099
Cr. stone	Ton mile	1,954.00		
Gravel	Ton mile	608.00		
Foundation excavation				
Earth dry	Cu. yd.	14,531.00	16,651.08	
Hard pan dry	Cu. yd.	8,488.00		
Loose rock dry	Cu. yd.	146.00		
Solid rock dry	Cu. yd.	578.00		
Earth in water	Cu. yd.	397.00		
Hard pan "	Cu. yd.	575.00		
Loose rock "	Cu. yd.	26.00		
Solid rock	Cu. yd.	41.00		
Culverts				
Unwatering			560.24	
Team transportation materials	Ton mile	5,803.00	2,444.30	0.41
Reinforcement	Lbs.	55,169.00		
Concrete	Cu. yd.	1,535.90	6,565.59	4.30
Backfilling	Cu. yd.	1,620.00	977.18	0.61
Coffer dams	F.B.M.	5,498.00	143.03	0.026
Manholes and catch basins				
Concrete	Cu. yd.	177.30	2,343.82	
Brick		36.40		
Temporary crib work				
Round timber	Lin. ft.	6,220.00	116.18	0.017
Iron	Lbs.	500.00		
Paving — dry	Cu. yd.	14.00	10.88	0.78
Pipe				
Corrugated 8"	Lin. ft.	60.00	109.48	0.20
" 12"	"	94.00		
" 18"	"	70.00		
" 24"	"	25.00		
" 30"	"	76.00		
" 48"	"	233.00		
Concrete 10"	Lin. ft.	157.00	775.27	0.06
" 12"	"	9,445.00		
" 18"	"	2,073.00		
" 24"	"	350.50		
" 30"	"	694.50		
Pipe				
Transportation team and train	Ton mile	3,460.00	2,840.75	0.82
Backfilling				
Crushing	Cu. yd.	828.80	993.84	1.20
Earth	Cu. yd.	6,031.00	5,951.72	0.34
Gravel & field stone	Cu. yd.	8,931.00		
Crushed stone	"	2,605.00		
Cinders		192.00		
Transportation field stone & gravel	Ton mile	13,846.00	10,176.21	0.74
Transportation crushed stone	"	5,367.00	1,343.22	0.25
Clay Pipe 4"	Lin. ft.	15,208.00	1,954.95	
6"	"	27,498.00		
6 x 6"	"	6,036.00		
8"	"	3,730.00		
9"	"	120.00		
10"	"	185.00		
12"	"	44,648.00		
15"	"	10.00		
18"	"	3,143.00		
24"	"	162.00		
Retaining Walls				
Masonry	Cu. yds.	57.20	465.44	4.78
Concrete	"	40.20		
Timber	F.B.M.	21,148.00	201.24	
Ties		350.00	77.43	
Iron	Lbs.	964.00		
Rip Rap				
Hand laid	Cu. yds.	319.20	649.12	2.03
Loose	"	11.00	13.01	1.18
Transportation	Ton mile	452.50	458.27	1.01
Temporary trestles				
Round timber	Lin. ft.	500.00		
Flatted timber		28,200.00		
Square timber	F.B.M.	3,640.00		
Iron	Lbs.	234.00		
Steel rails		9,480.00		
Transportation	Ton mile	161.00	218.28	1.36
Bridges				
Excavation				
Earth dry	Cu. yd.	1,648.00	2,975.58	1.19
Hard pan dry	Cu. yd.	404.00		
Solid rock	Cu. yd.	156.00		
Earth in water	Cu. yd.	55.00		
Hard pan "	Cu. yd.	10.00		
Solid rock "	Cu. yd.	239.00		
Coffer dams and shoring sawn timber 2 x 10	F.B.M.	790.00	137.29	0.18

Description of work	Unit	Quantities	Total cost	Average unit cost
Piles				
Number	No.	52.00	270.92	0.14
Left in work	Lin. ft.	1,664.00		
Cut off	"	156.00		
Backfilling	Cu. yds.	819.00	1,080.92	1.32
Reinforced concrete				
1—2—4 mix	Cu. yds.	1,700.50	8,594.65	5.06
Reinforcement	Lbs.	63.283.00		
Transportation				
Train	Ton mile	3,755.00	3,244.14	0.36
Team	"	5,500.00		
Fencing				
Length fenced	Rods	186.00	102.78	
Wire	"	186.00		
Fence posts	No.	136.00		
Gate and anchor posts	"	6.00		
Gates	"	2.00		
Lord surveyors monuments	"	372.00	843.10	
Concrete	Cu. yds.	16.00		
Reinforcement	Lbs.			
Guard rails				
Wooden	Lin. ft.	640.00	25.32	
Concrete	"	1,397.00	829.23	0.60
Reinforcement	Lbs.	1,630.00		
Roadway				
Macadam surfacing	Sq. yds.	11,912.00	1,819.61	0.15
Concrete surface	Sq. yds.	312,102.00	85,741.10	0.275
Reinforcement	Sq. yds.	101,694.00	679.02	0.007
Water	1000gals.	16,077.00	1,774.17	0.110
Transportation teams	Ton mile	2,153.00	99,265.49	0.255
Train and team train	"	386,077.00		
Shoulders				
Crushed stone	Cu. yds.	1,785.00		
Earth	"	18,362.00	9,050.65	0.50
Approaches				
Crushing stone	Cu. yds.	753.00		
Crushed stone	"	1,711.00	715.51	0.36
Gravel	"	269.00		
Transportation team				
Crushed stone	Ton mile	4,630.00	1,498.70	0.33
Gravel	"	302.00	851.15	

Constantly rising costs for labour and materials increased the average price per sq. yd. of concrete roadway from $1,273 in October 1915 to $1,454. When it was brought to the attention of the Government that the constantly increasing costs would make it impossible to complete the work within the estimates made in April 1916, an additional appropriation of $100,000.00 was made.

The rates paid for labour and teams are as follows:

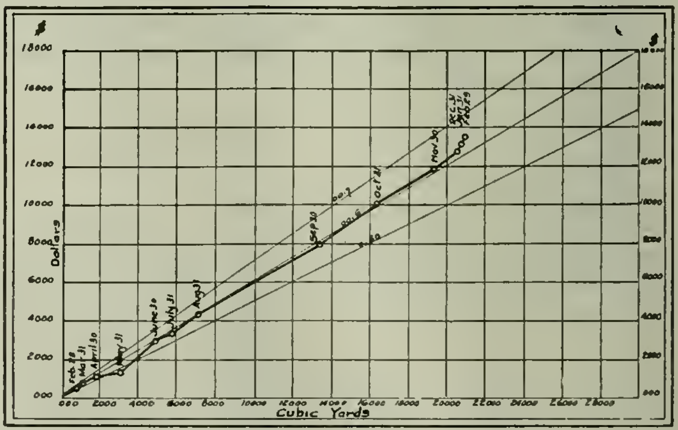
	Labour	Teams
Nov. 1914	$0.20 per hour	$0.48 per hour
Jan. 1916	0.25 "	0.52½ "
June 1917	0.30 "	0.70 "
July 1917	0.32½ "	0.70 "
Aug. 1917	0.35 "	0.70 "
June 1818	0.37½ "	0.70 "
July 1918	0.40 "	0.85 "



Monthly Progress and Expenditure Chart — Excavation.

Construction in York County

A question which will naturally arise is why the section nearest to Toronto was the last to be built. During the summer of 1914 the Department of Highways made a preliminary survey of the Lake Shore Road which was completed before the Commission was formed, and which was the only basis for the early work of the Commission. Largely on account of the fact that a Dollarway pavement had been constructed for the first two miles out of Toronto and the belief that contracts had been let or were pending for additional work, this survey did not begin at the boundary of Toronto at the Humber, but at the Westerly boundary of New Toronto instead. When the Commission was advised October 16th, 1914, that upon obtaining agreements with the Cities of Toronto and Hamilton, the work could be proceeded with, the matter was at once laid before the two Councils, Toronto's agreement being received October 26th, and Hamilton's October 27th. Negotiations were then opened with the York Highway Commission, regarding the York County section. When construction work began in November 1914, it was very evident that the greatest need for relief work came from Toronto, and when arrangements were made regarding the transportation of the Toronto men, tickets



Monthly Progress and Expenditure Chart — Foundation — Excavation.

were printed for various points in York County, but the failure to agree with the York Highway Commission prevented getting the work under way.

Early in 1915 delegations from Mimico and New Toronto appeared before the Commission, outlining a plan for a Highway 86 feet in width, radial tracks in the central portion and two paved roadways. They also said that the two municipalities were installing joint sanitary sewers and a disposal plant, and completing a water system. The Commission recognized the advantages of the wider highway, but doubted the desirability of a form of construction which would require traffic to cross the radial tracks at the limits of Mimico and New Toronto. They felt that the same form of construction should be adopted throughout the county. Estimates were prepared, but no agreement could be reached as to the basis of distributing the cost.

Laying Reinforcement in Oakville.

The Commission's surveys showed how serious the situation on this section of the Highway was. East of Church street in Mimico, none of the roadway was 66 feet in width, the narrowest portion being only 38 feet. There were some very dangerous curves. The Toronto and York Radial Railway complicated matters still more. Their tracks were on the highway. Their rights were not clearly defined. Some of the municipalities interested desired provision for double tracking, others felt that they should be removed entirely from the highway.

With these difficulties facing them and having in mind that the York Highway Commission had already incorporated the Lake Shore Road to the county line in their plan of improved roads, the Commission looked for another solution to its problem and proposed a variation from the original route plan. The new location would have taken the highway under the Grand Trunk Railway near the Etobicoke, crossed the farm lands just east of the Etobicoke diagonally, and joined Queen street. It was slightly shorter than the Lake Shore Road, and could have been constructed for less money than any adequate solution to that route. It would have opened a new farming district to the Toronto Market, and would have been practically free from intersecting streets to the great advantage of through traffic.

This proposition was not received kindly by the City of Toronto, or by those in the vicinity of the two routes. The Commission reluctantly abandoned this scheme, and turned its attention once more to the Lake Shore Road. It felt that the addition of the great amount of local traffic in this section to the large and growing through traffic would make the construction of a roadway of the standard width little short of criminal. As no mutually satisfactory arrangements could be arrived at, the Commission made application to the Ontario Railway and Municipal Board for permission to widen the concrete roadway to 24 feet from the western boundary of O'Connor Road to the Toronto line. The Board's decision ordering a wider roadway was issued June 22nd, 1917.

The installation of sewers and water mains in Mimico and New Toronto prevented the possibility of Highway construction during 1915 and 1916. It was planned to have all the trenching on the Lake Shore Road completed by December 1st, 1916, however, which would have given some chance for the backfilling to settle. Delays prevented this schedule being followed.

In presenting its estimates in connection with the application made to the Railway Board to widen the roadway, the Commission included items covering the cost of storm sewers, catch basins, boulevard grading and curb work. It was held, however, that this work was optional with the municipalities. Mimico and New Toronto requested that this special work be done but in Etobicoke Township, East of the Town of Mimico, the Commission found itself in the position of having to acquire land at considerable cost, utilize a large portion of it for an undesirable open ditch construction and place the concrete roadway in such a location as to make it extremely likely that it would have to be torn up within a few years if that section should develop to the extent that the Commission anticipates. Many meetings were held with the Township Council and the rate payers in that section but it was not until September 13th, that an agreement was reached under which the work could proceed. As the laying of the concrete in this section was completed October 28th, fair progress was made, especially since it was necessary to acquire land, move three pole lines and the radial tracks, in addition to the regular grading and concreting in that period.

In presenting its estimates before the Ontario Railway and Municipal Board in connection with its application for permission to widen the roadway in York County the Commission asked that the cost of construction beyond that contemplated in its estimates of April 1916 be considered as increased cost due to widening. The estimates were as follows:—

York County Estimate

Estimate of cost of constructing a 2′ macadam and 24′ concrete pavement from the West limit of the City of Toronto to the O'Connor Road. From the West limit of the City of Toronto to the West limit of the Village of New Toronto (on the South side of the Lake Shore Road) provision has been made for a curb and 11.5′ of boulevard also for replacing existing sidewalks

Concrete Bridge at Bronte.

that it may be necessary to remove, from the West limit of New Toronto on the South side of the Lake Shore Road to the O'Connor Road, this estimate provides for an open ditch on the South side instead of curb, tile drains, etc. Also this estimate does not include:

1. **Extra right-of-way:** All expense, survey property costs, land damages, etc. in connection with acquiring extra right of way at places where necessary, that is, from the West limit of the City of Toronto to Church Street in the Village of Mimico.
2. **Bridge at Mimico Creek.**

Summary

		Dist. ft.	Cost. $
Sheet No. 2F	**Etobicoke Township** West limit of City of Toronto to East limit of Mimico.	5810	89,032.47
Sheet No. 3F	**Mimico**	7557	103,203.84
Sheet No. 4F	**New Toronto** From East boundary to West boundary on South side Lake Shore Road.	3304	38,898.44
Sheet No. 5F	**New Toronto and Etobicoke Township** From West boundary of New Toronto on South side Lake Shore Road to West boundary New Toronto on North side of Lake Shore Road.	3314	34,172.15
Sheet No. 6F	**Etobicoke Township** From West limit of New Toronto of North side of Lake Shore Road to West side of O'Connor Road.	5329	49,464.61
		25314	314,771.51

As this work is now completed it is interesting to compare the figures of this preliminary estimate with the final statement of cost presented to the Railway Board. When the final distribution of cost was made the Provincial Government accepted as a proper share for the Commission the cost of a concrete highway 18 feet in width through the section where widening was ordered and provided the additional money required on this basis. The final statement of cost is as follows:—

York County Work

Final Statement

Statement of expenditure up to January 31st., 1920 upon construction of 24′ concrete roadway from West limit of City of Toronto, to the O'Connor Road.

Item		Unit	Quantity	Unit cost	Total cost
1	Scarifying......				
2	Removing old pavement	Lin. ft.	11029	.8281	$ 9,133.53
3	Grading..............	Cu. yd.	22051	1.364	30,077.00
4	Borrow...............				
5	Rolling...............	Sq. yd.	73204	.01916	1,402.54
6	Excn. in foundations...	Cu. yd.	1347	1.7983	2,422.35
7	Concrete pipe, 12″....	Lin. ft.	512.5	1.0143	519.85
8	" " 18″....	"	498	4.2556	2,119.29
9	" " 24″....	"	64	4.8683	311.57
10	" " 30″....	"	64	6.3619	407.16
11	Culverts reinforced.....	Cu. yd.	134	21.3373	2,859.21
12	Concrete head walls....				
13	Rip rap...............				
14	Excn. for tile drains... (including backfill)	Cu. yd.	11321	1.1295	12,786.70
15	Stone backfill..........	Tons	2952	3.7665	11,118.81
16	Pipe laying............	Lin. ft.	42476	.04	1,698.82
17	Vitrified pipe 9″......	Lin. ft.	42476	.1382	5,869.68
18	" " 15″......	"	422	.353	148.88
19a	" " 18″ 24″..	"			1,574.97
19	" elbows and T's				205.82
20	Catch basins..........	Each	88	51.894	4,566.67
21	" pipe & grate....				
22	Fine grading..........	Sq. yd.	70103	.08673	6,030.38
23	Concretepavementenfd.	Sq. yd.	67527	2.4761	167,200.76
24	Extra reinforcing......	"	33265	.1430	4,757.33
25	Concrete curb.........	Lin. ft.	19612	.2874	5,636.30
26	Sidewalks—new.......				14,791.33
27	" removing old				360.37
28	Moving poles..........				2,839.73
29	Shoulders-earth........				
30	Guard rail............				110.35
31	Stone for street approaches.........				
32	Radial changes........				
33	Macadam.............	Sq. yd.	9932	.7702	7,649.78
					$296,649.18
	Of this total, $288,993.20 was expended prior to 31st. January 1919—therefore add interest at 6% on $288,993.20 for one year...........				17,339.59
					$313,988.77

As the estimated cost exclusive of interest charges was $314,771.51 the actual cost was $18,122.33 within the estimate a noteworthy showing in such unsatisfactory years for construction work as 1918 and 1919.

Conclusion

The auditors' statement for December 31st, 1920 shows that up to the present time the Commission has expended on the 35.28 miles of roadway $1,142,309.19 which is at the rate of $32,378.37 per mile.

To some this may seem to be a very large expenditure but The Honourable Minister of Public Works for Ontario in a recent public speech said that land values alone had increased $6,000,000.00 since the construction of the Highway was first considered as possible. This is at the rate of nearly $170,000.00 per mile. Even a war profiteer would have been satisfied with such a return as that. As an evidence of the appreciation in which the Highway is held a comparison of traffic counts for the past several years is valuable. A traffic census was taken by the Provincial Department of Highways in 1914 before construction work was begun. The Commission has taken counts yearly since on days which it was felt would show the miximum traffic count.

Year	1914	1916	1917	1918	1920
Motor cars....................	262	1876	3065	4429	7783
Motor trucks..................	3	142	107	93	131
Light horse drawn vehicles.....	199	271	148	20	4
Heavy horse drawn vehicles....	56	184	41	51	37
Miscellaneous................		781	479	1081	448
Total....................	520	3254	3840	5674	8403

Under the Act the Commission prepares each year a maintenance statement. The one just recently issued summarizes maintenance costs year by year and can properly be considered as a part of this record. When read in conjunction with the traffic figures just given it is particularly valuable.

Part of the Complete Highway.

In conclusion the writer wishes to voice his appreciation of the kindness of the Provincial Dept. of Highways and the Toronto Hamilton Highway Commission in permitting this information to be presented and for courtesies extended while it was being assembled; also to acknowledge the special assistance given by S. A. Cummiford, A.M.E.I.C., at present chief engineer to the Commission. It would be entirely proper to mention by name the entire staff whose whole hearted co-operation under what was at times very trying conditions, made the carrying through to completion of this work a pleasing task. The assistant engineer was Charles Johnston, M.E.I.C. and the supt. of construction during the earlier part of the work was Capt. Richard Bell. The secretary to the Commission was Lt.-Col. Carl W. Allan, M.E.I.C. The members of the Commission have already been mentioned by name. Surely no public body has more consistently held out for what it believed to be right regardless of the opposition offered. No organization ever had more loyal supporters. The first engineer of bridges was Major Westropp Armstrong.

Comparative Maintenance Statement for 1916, 1917, 1918, 1919, 1920

	1916	1917	1918	1919	1920
Road Surface:					
Concrete	$ 642.49	$1,715.98	$2,195.59	$1,726.68	$2,533.75
Macadam	1,306.16	3,174.30	9,726.98	7,491.90	4,077.61
Shoulders: Including Washouts, etc.		566.85	1,565.10	3,697.26	3,128.46
Snow Removal			2,560.57	905.30	2,347.50
Miscellaneous: Repairs to Guard Rail, Drains, Cleaning Ditches, Fences, etc.	2,942.85	739.80	3,379.77	5,097.39	5,130.10
Bridges			1,770.13		
Storehouse: Tool House, etc.				1,503.07	
Plant: Office Furniture, Automobile and Motor Trucks				7,779.26	2,186.98
Damage Claim and Expenses					1,960.95
General: Including Rents, Salaries, Legal Expenses, Printing, Stationery, etc.	623.96	1,161.40	2,905.35	3,017.84	6,287.14
Betterment: Trees, Planting, Pruning and Protecting	1,145.33	1,442.31	3,047.74	2,416.75	708.04
	$6,660.79	8,800.64	27,151.23	33,635.45	28,360.53
Less Charged to Hamilton and Oakville under agreement as their share of repairs to unfinished part of road			2,813.33	6,418.37	1,258.58
	$6,660.79	8,800.64	24,337.90	27,217.08	27,101.95
Net Receipts: Fines Account	1,858.98	9,707.22	26,317.57	14,973.27	24,184.07
	Dr. $4,801.81	Cr. $ 906.58	Cr. $1,979.67	Dr. $12,243.81	Dr. $2,917.88

Maintenance of Concrete Road Surface in 1916	(16 miles)	$ 40.14 per mile
Maintenance of Macadam Road Surface in 1916	(1.17 miles)	1,116.17 per mile
Maintenance of Concrete Road Surface in 1917	(29 miles)	59.17 per mile
Maintenance of Macadam Road Surface in 1917	(1.7 miles)	1,867.23 per mile
Maintenance of Concrete Road Surface in 1918	(36 miles)	60.99 per mile
Maintenance of Macadam Road Surface in 1918	(1.7 miles)	5,721.75 per mile
Maintenance of Concrete Road Surface in 1919	(36 miles)	47.96 per mile
Maintenance of Macadam Road Surface in 1919	(1.2 miles)	6,243.25 per mile
Maintenance of Concrete Road Surface in 1920	(36 miles)	70.38 per mile
Maintenance of Macadam Road Surface in 1920	(1.2 miles)	3,398.01 per mile

Certified Correct:
S. A. Cummiford,
Chief Engineer.

Toronto, November 1st, 1920.

Amounts Charged to Municipalities

City of Toronto	$1,111.80
City of Hamilton	222.37
County of Wentworth	105.10
Township of East Flamboro	127.19
Township of Nelson	207.08
Town of Burlington	69.80
Township of Trafalgar	354.29
Town of Oakville	68.89
Township of Toronto	338.07
Village of Port Credit	84.18
County of York	141.23
Township of Etobicoke	45.72
Town of Mimico	25.44
Town of New Toronto	16.72
	$2,917.88

Toronto Harbour Improvements

Toronto Harbour, past, present and future, an account of progress with details of construction work to date and future plans.

Edward L. Cousins, A.M.E.I.C.
Presented by George T. Clark, A.M.E.I.C.

Paper Presented at the General Professional Meeting, Toronto, February 3rd, 1921.

The Toronto Harbour Commissioners were incorporated by an Act of the Federal Government dated May 19th, 1911. As provided for in this Act, the Commission consists of five members appointed for three year terms. Three of the members are appointed by the City of Toronto and two by the Federal Government. One of the Government's representatives is a direct appointee, and the other is on the nomination of The Toronto Board of Trade.

The present Commissioners are:—

Hon. L. H. Clarke, Chairman	Representing the City of Toronto.
T. L. Church, K.C., Mayor	
R. Home Smith	
R. S. Gourlay	Representing the Federal Government.
John Laxton	

These Commissioners have served since their appointment without any remuneration, although the Act of incorporation does not require them to do so.

The activities of the Commission commenced in February 1912. Surveys were made over the entire waterfront from the East City Limits to the Humber River. These survey notes when plotted, showed in detail the then existing conditions, including the locations of buildings, wharves, shore lines and railway tracks. Numerous lines of levels were run, and from the information so obtained estimates were made of the quantity of filling required. Approximately six thousand borings and soundings were taken at intervals over the entire Harbour, and from these the necessary information was obtained as to the elevation and nature of the rock, and as to the quantities of various classes of material available for filling purposes.

Plan of Development

The Commissioners after careful consideration of all phases of the question, included in their plans for the development of the waterfront, the following:—

1. Provision for adequate facilities for industrial and commercial expansion.
2. The improvement of transportation facilities by co-ordinating rail and water traffic.
3. The reclamation and improvement of lands for park and recreation purposes.

Toronto occupies the position of being one of the largest and most rapidly growing industrial and commercial centres in Canada, and on account of its geographical location, is the largest manufacturing and distributing centre.

With the above in mind, some twelve different studies were made of the entire waterfront, and in the Fall of 1912 plans were projected, embracing the following:—

Reclamation of 892 acres of park lands in the Western, Eastern, and Island sections.

Reclamation of 1,010 acres for industrial and commercial uses in the Eastern section.

Construction of breakwater from Eastern Channel to Woodbine Avenue, a distance of three miles, and from Western Channel to Humber River, embracing a distance of three and one-half miles.

Construction of three and one-half miles of modern dockage facilities in Eastern Harbour Terminal.

The development of the portion of Inner Harbour between York and Yonge Streets, then owned by the City, embracing dock frontage.

Waterfront Ownership

The City of Toronto had previously deeded to the Harbour Commission all the waterfront properties owned in 1911 by the City of Toronto, with the exception of Toronto Island, properties at foot of John Street and Princess Street, the former being Waterworks Station and the latter Works' Department Yards, and street ends.

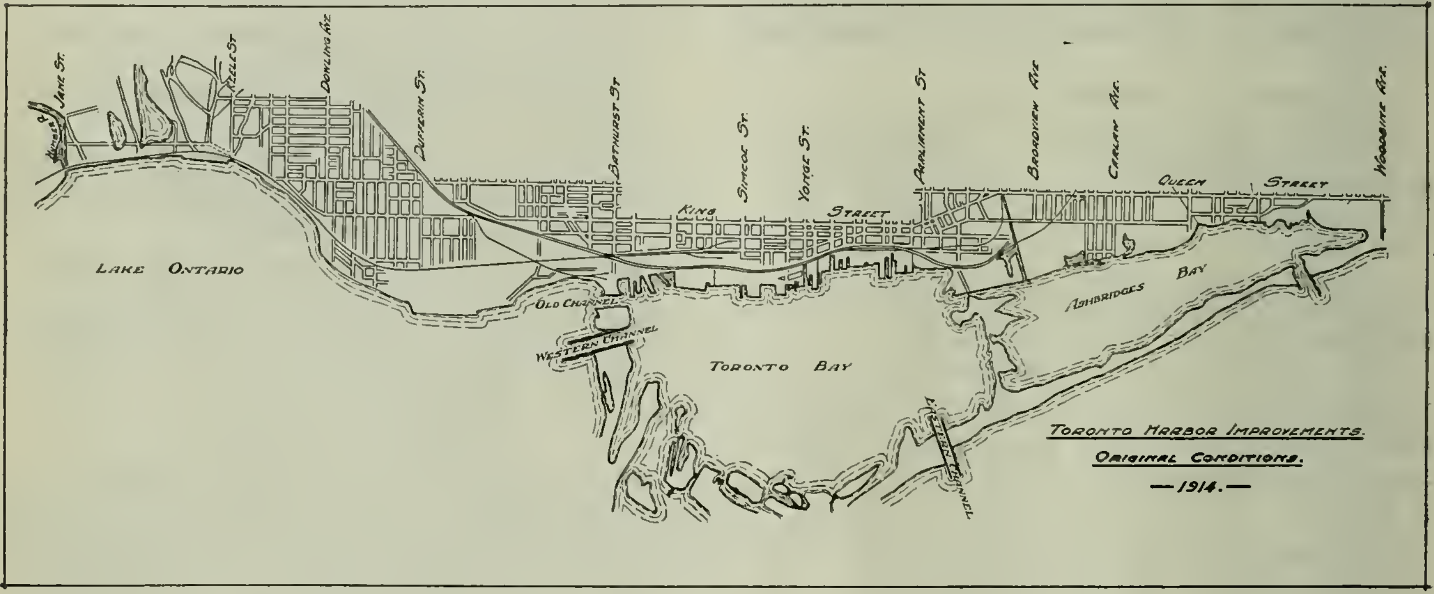
Fortunately the City of Toronto had in previous years obtained possession of all waterfront and riparian rights in the West end by means of expropriation, and had retained the title in what was then called Ashbridge's Bay marsh.

Dealing with the Inner Harbour waterfront in 1912 the Commission, on account of having limited ownership, were not in a position to project any plans at that time for the development of that portion of the waterfront between Bathurst and Cherry Streets, a distance of approximately two and one-half miles, with the exception of the portion between Yonge and York Streets previously referred to.

The development plans called for a total expenditure of $19,142,088 which had been prepared on the basis of the Dominion Government contributing $6,123,284 and the City of Toronto and Toronto Harbour Commission $13,018,804.

The plans for the development proposed were presented to the City of Toronto and Federal Government and approved and, in accordance with the Government work, Order in Council was issued covering same and agreement was prepared between the City of Toronto and Harbour Commission, covering their respective interest in the waterfront improvements.

In 1913 the Viaduct Agreement providing for grade separation across Toronto's waterfront was signed by all parties thereto, namely, Canadian Pacific Railway, Grand Trunk Railway, City of Toronto and Toronto Harbour Commission, as a result of which the Harbour Commission are to obtain the ownership of that portion of the inner Harbour waterfront from Yonge to Cherry Streets, of which the City and Harbour Commission had jointly owned about thirty per cent.



From York Street through to John Street the Canadian Pacific Railway held a lease in perpetuity of said property, and from a point just West of John Street through to Bathurst Street was owned by the Grand Trunk Railway. As a result of negotiations between the Commissioners, Canadian Pacific Railway and Grand Trunk Railway arrangements were made, covered by agreement, which enabled the Commissioners to obtain control of the riparian rights of that section of the waterfront from York to Bathurst Streets, so that at this date, by agreements or otherwise, the Toronto Harbour Commission are now in control of practically ninety-nine per cent. of the waterfront from the Humber River through to Woodbine Avenue, a distance of nine miles. In regard to that section of the waterfront from Woodbine Avenue to East City limits, a distance of one and one-quarter miles, arrangements have now been made by the City to expropriate all waterlots that are not now owned by the City and Harbour Commission so that, generally speaking, it can be said that the Toronto Harbour Commission are in control of practically the entire waterfront of Toronto.

Eastern Harbour Terminals

The objective of the Commissioners in this area which has been termed Eastern Harbour Terminals, was to develop by means of reclamation 1,010 acres for industrial purposes, or what might be termed a district created for heavy manufacturing, the centre of which is approximately one and one-half miles from the centre of the city; also to provide in this district every facility that would be of advantage to incoming industries, placing property in their hands at cost, ultimately giving service from all railways with free interswitching charges, providing the advantage of water borne transportation, and leasing property having riparian rights at a rental based at the rate of five per cent., of the cost of improvements.

Central Harbour Terminals

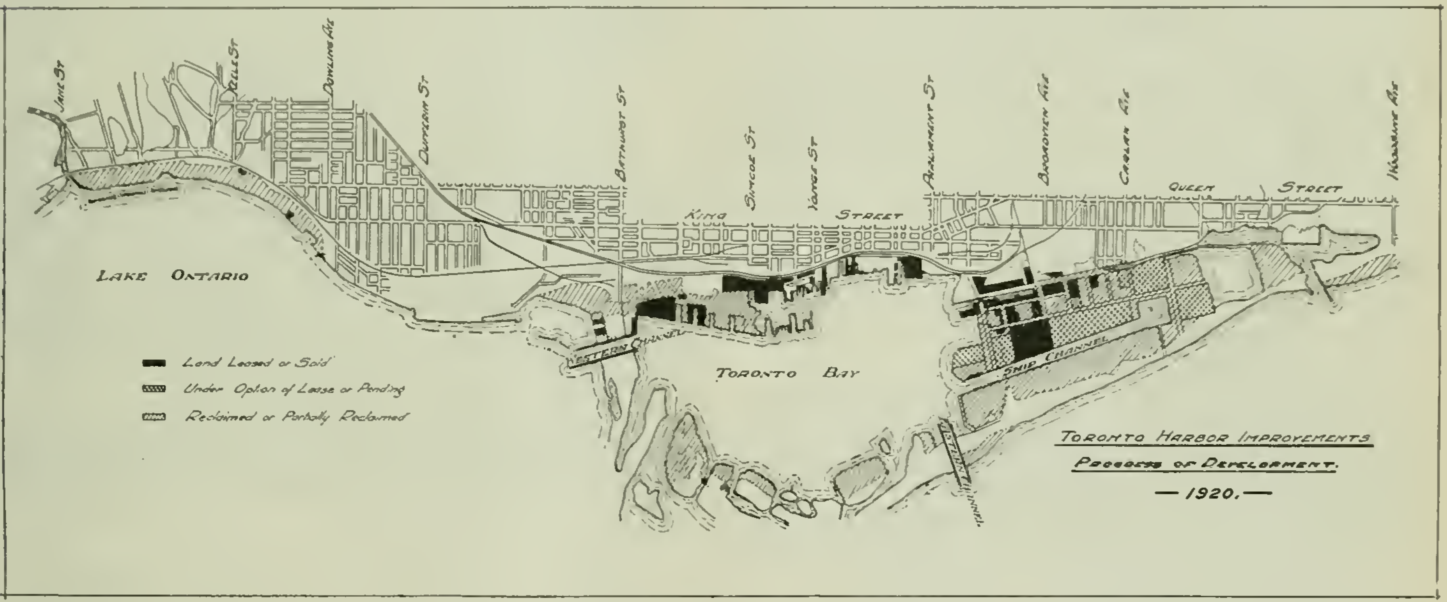
As applied to Inner Harbour waterfront, between Bathurst and Cherry Streets, it was decided to develop this section to be known as the Central Harbour Terminals, for the purposes of light loft type manufacturing, warehousing and cold storage facilities; also by pier and slip construction to improve the means of co-ordinating railway and water-way traffic.

Park Reclamation

In the Eastern section, from the Eastern Channel to Woodbine Avenue, it was planned to provide for the reclamation of 352 acres of park lands, having in mind on completion of this development the setting aside of a portion of this park for housing facilities for employees of the industrial district to the north thereof.

In the Central section, that is between Eastern anp Western Channel, it was proposed to add 350 acres of additional park lands to the Island areas and in the Western section, from Western Channel through to Humber River, to provide for reclamation of 192 acres of park lands, or a total of 894 acres of park lands across the entire waterfront.

It is now proposed, in addition to the above, to reclaim some 40 acres for park and recreational purposes between Woodbine Avenue and Eastern City Limits, plans for which have recently been brought down and approved by the City.



Toronto Harbor Improvements
Progress of Development.
— 1920. —

Boulevard Drive

It was also proposed to construct a boulevard drive from Humber River along the waterfront to Bathurst Street and across Toronto Island, crossing the Western and Eastern Channels by movable bridges, and then carrying same Easterly from Eastern Channel to Woodbine Avenue, a total distance of approximately twelve miles. It was proposed further to have this waterfront boulevard drive connect with a similar drive, being projected by the City belting the Eastern, Northern and Western sections thereof, which would be some thirty miles in length, the whole of which on completion would form a drive of some forty-two miles, encircling the entire City.

Objective of the Commission

In the main the objective of the Commission was to provide Toronto with an improved harbour and transportation facilities, coupled with ample provision for the industrial and commercial expansion of the City. The feeling was, that providing the above facilities could be given to industry and commerce on such terms and conditions as would enable the Commission to receive a return on the investment sufficient to meet the interest and sinking fund, the intangible assets accruing to the City of Toronto, as a result of this additional industrial growth, would amply repay them for their efforts.

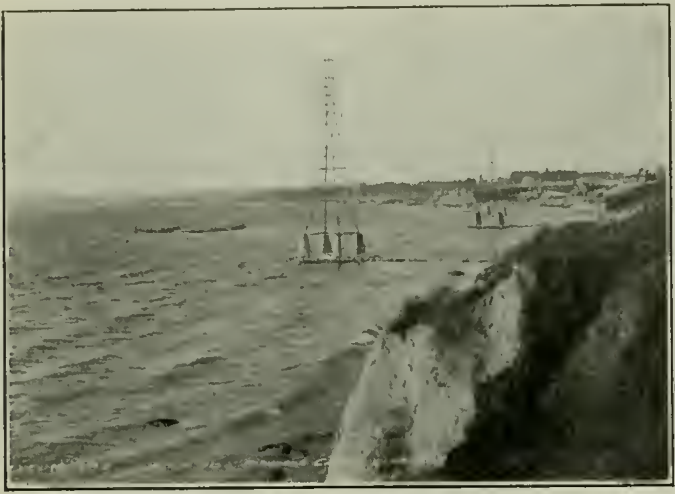
Finance

The financing of the undertaking was on the basis of a trust deed securing twenty-five million dollars worth of four and one-half per cent. debenture stock or bonds guaranteed by the City of Toronto, to be issued from time to time as conditions warranted.

Geological Formation

The bottom along the North shore of the Harbour is black bituminous shale interstratified with dark calcareous stone. This same formation underlays, and in a great measure forms a part of, the ridge separating the Harbour from Ashbridge's Marsh to the East, but at Gibraltar Point the formation is different, the shale formation being overlaid by common blue clay or marl and the clay is overlaid by masses of sand and other alluvial deposits. In the opinion of geologists, this proves that Toronto Harbour is an excavated basin separate from Lake Ontario, the excavation being made by powers which have ceased to act since the waters of Lake Ontario have subsided to their present level.

The borings previously referred to showed that the elevation of this strata of rock varies greatly along the ten mile waterfront. At the Western Channel it is



General Conditions in Humber Bay, 1914.
View Looking West.

twenty feet below zero of the Harbour Commissioners' gauge, while three miles further West, at the mouth of the Humber River, it is approximately fifty feet below the same point. From the Western Channel Easterly to Cherry Street along the inner waterfront the distance to rock increases from twenty feet to forty feet, and remains fairly uniform at the latter figure from Cherry Street to Woodbine Avenue. Along the Southern edge of Ashbridge's Marsh it varies from forty-five to seventy feet, and just outside the Eastern Channel the distance to rock is one hundred and six feet.

These borings and soundings also showed that in the inner Harbour there were 18,000,000 cubic yards of material available for reclamation purposes. The dredging of this material served a double purpose, the Harbour was deepened by its removal and land was reclaimed by depositing it within confined limits. By making these confining walls of modern wharf construction the reclaimed areas were placed immediately adjacent to dockage facilities, thus accomplishing the Commissioners' second objective, namely, the better co-ordination of rail and water traffic.

View in Same Direction in 1920—Showing
Reclaimed Land, Boardwalk and Boulevard Drive.

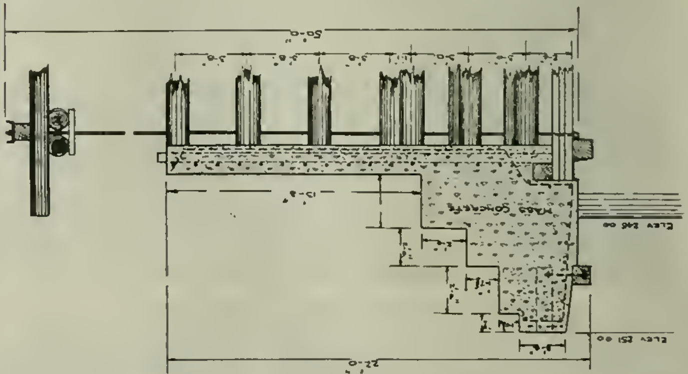
The construction of these retaining walls is one of the most interesting features, from an engineering standpoint, of the whole development work. The type of wall adopted depended largely on the depth of rock below mean water level. This was due to the fact that the development was to provide for an ultimate navigable depth of thirty feet. On this account, when the depth to rock was in the neighbourhood of thirty feet a crib type of wall was necessary; where the depth to rock was forty feet or over, a channel thirty feet deep could be dredged, and there would still be left ten feet of material for penetration of piling, and in such cases the pile type of wall was adopted. The Ship Channel wall is an example of the latter type, and the Harbour Head wall of the former.

Ship Channel Walls

The Ship Channel wall consists of tongued and grooved close sheet piling of British Columbia fir made up of 12" x 12" timbers with strips spiked to both sides forming close sheet piling. These piles are forty feet long and are driven in front of the structure. They are cut off squarely and evenly at the level of the top of the substructure elevation,, namely, at elevation 243.0 feet, or two feet below the zero of the Harbour Commission gauge.

Two stringers run along the top of the close sheet piling, one on the rear face and one on the front face, the two stringers being tied together by one inch bolts. The rear stringers are of timber and the face stringer is a fifteen inch steel channel.

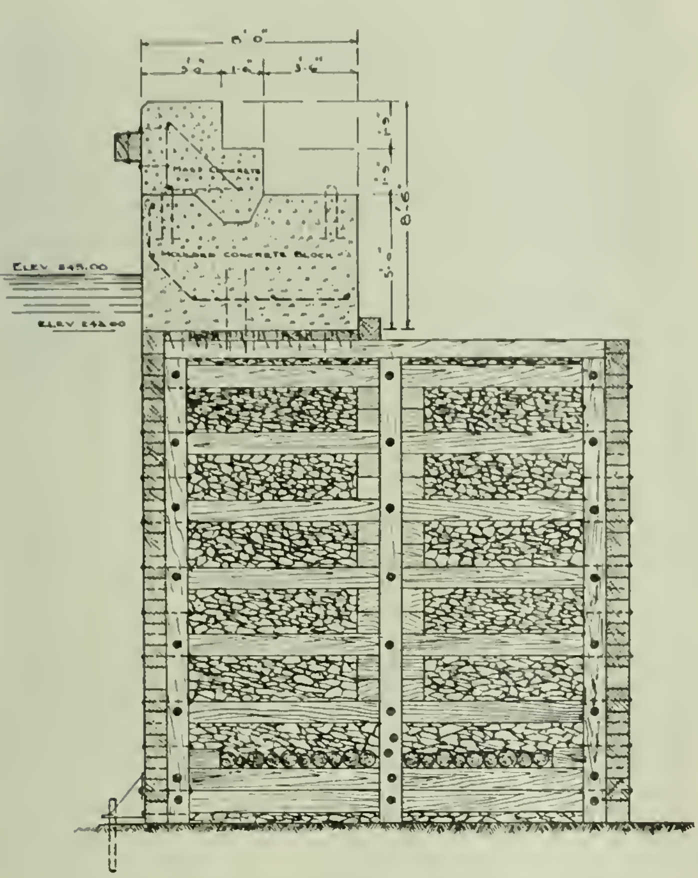
Pile bents driven at right angles to the line of the work form the foundation for the wall and brace the wooden sheet piling. The spacing of all bents longitudinally is at five foot centres. These piles are of spruce 14" diameter at the butt end and 8" at the point. Cap



Section of Ship Channel Wall.

timbers are of 6″ x 12″ hemlock and securely drift-bolted to the top of each pile.

The concrete superstructure was originally intended to consist of reinforced concrete blocks, upon which was to be superimposed a mass concrete top. The work was actually carried out, however, by constructing a dam across the West end of the Channel and lowering the water in the Ship Channel to an elevation approximately eight feet below the lake level. This enabled the contractor to cut off all piles, set the cap timbers, and place the entire concrete superstructure in the dry. It also made possible a closer inspection of the various steps in the progress of the work. The concrete was mixed in the proportions of one of cement, two of sand, and four of broken stone or an approved grade of gravel. It was moulded in fifty foot longitudinal sections with proper provision for contraction at each joint.



Section of Harbourhead Walls.

Anchor rods were placed on ten foot centres along the superstructure. The rods are 2″ in diameter, fifty feet long and extend from the front face of the timber sheet piling back to anchor piles driven at two-foot centres. Turnbuckles are provided on each rod.

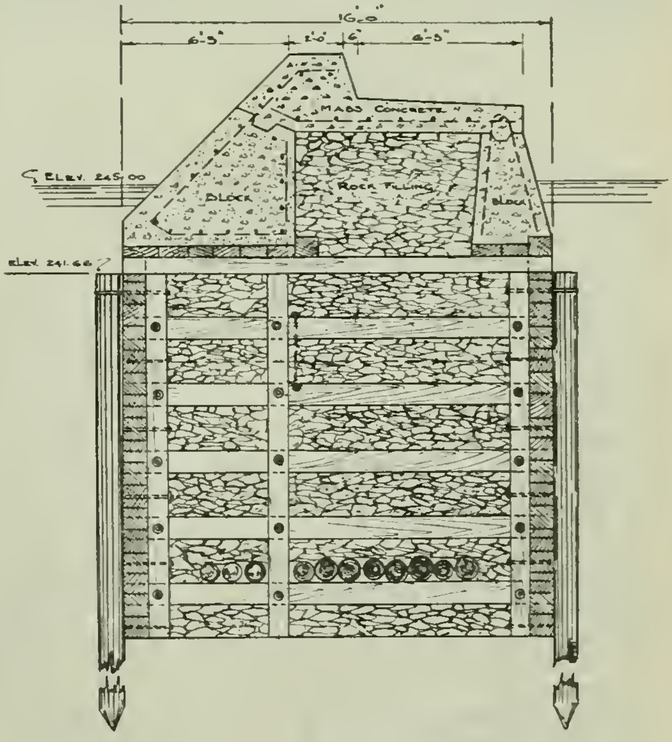
Cast iron bollards of the Scotch type are provided on the face of the Ship Channel and Turning Basin walls and are spaced seventy-five feet apart.

This type of wall was used for the construction of the Ship Channel, Turning Basin, Circulating Channel, Marginal Way walls, and a portion of the Don River retaining walls. The balance of the Don River wall and the retaining wall at the Humber River were of the same type except that steel sheet piling was used instead of timber sheet piling.

Harbourhead Walls

The other type of wall used in connection with the development work was the crib type. This was used in the construction of the Harbour Head walls from Bathurst Street Easterly to York Street, which have been completed, and from York Street to Yonge Street, which are under construction.

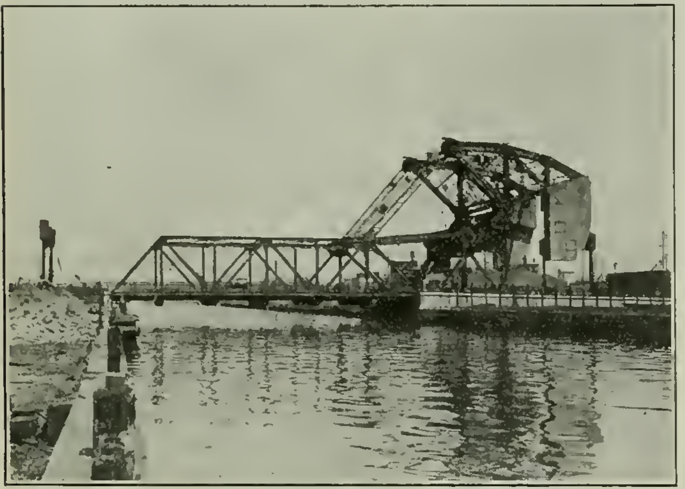
This structure consists of rock filled crib work in sections of standard lengths of one hundred feet, and special lengths as required to make up odd distances. The section of these cribs in general is square, varying from eighteen feet to twenty-six feet by two-foot intervals. In addition to the timbers shown on the general cross section, longitudinal ties were placed in all cribs over twenty-four feet in width.



Section of Western Breakwater.

Berths or trenches were dredged to bed rock. The rock surface was made even and regular, and of sufficient width to provide an even bearing for the cribs throughout their entire length and breadth. Before placing the cribs the rock was cleaned and levelled, and careful soundgins taken in order that the crib would be constructed to fit the bottom accurately.

After being sunk and held in position by sinking blocks, the cribs were filled with stone, of a quality as hard and durable as good building limestone. The various sections of crib work were fastened together by interlocking end posts.



Cherry Street Bascule Bridge.

After the cribs were sunk in position, lined, filled with stone and allowed a reasonable time for settlement, the vertical posts were cut off and capped and the flooring laid to receive the pre-moulded concrete blocks. The elevation of the top of the wooden structure is 243.

The superstructure consists of pre-moulded concrete blocks 8′ x 5′ x 5′ with sides bevelled front to back, thereby making possible a perfect alignment. After being placed and lined, the blocks are keyed to the plank flooring and also to each other. The concrete mass as shown in section is placed on the blocks and tied to the latter by reinforcing steel. Contraction joints are placed at every fifty feet, and mooring bollards every seventy-five feet as in the case of the other walls.

This type of wall was also used in the construction of the extension of the Exhibition sea wall and the Western Breakwater. The latter is a structure 18,500 feet long, extending from Bathurst Street to the Humber River. It is being built to serve a three-fold purpose, (1) to prevent erosion of the shore, (2) to provide a protected waterway for pleasure craft, and (3) to raise the temperature of the water behind it for bathing purposes.

Dredging

The final plans of the proposed development approved in 1913 called for a total reclamation of approximately 2,000 acres, which required 32,000,000 cubic yards of filling, to be done by hydraulic dredging. This work was let by contract, and two dredges, the "Cyclone" and "Tornado" were specially designed for this work and were built in a Toronto shipyard. Their principal dimensions are as follows:—

Length 170′
Beam 42′
Engine horse power 1750
Diameter of impellor 8′
Diameter of suction 24″
Diameter of discharge 24″.

Their hourly capacity is from 400 to 1200 cubic yards, depending mainly on the material handled. Working under all conditions, the "Cyclone" during six years of operation has averaged 611 cubic yards per working hour.

Cherry St. Bascule Bridge

As the greater portion of the lands reclaimed in the Eastern section were South and East of the Don River, it was necessary to provide a movable bridge at Cherry Street to give access to this district. The type of bridge chosen was a Strauss Bascule Trunnion. It is a single leaf structure, 120-foot clear span, 66 feet wide over all and a 42-foot clear roadway with double track street railway. It is operated by two 100 horse power motors and all operations are interlocked and under one control.

The structure rests on four concrete cylinders, sunk to rock. The main trunnion piers are six feet in diameter and have a reaction of 680,000 lbs., and the counterweight trunnion piers are eight feet in diameter and have a reaction of 1,080,000 lbs. The concrete is mixed in the proportion of 1—2—4 and is incased in steel sheet piling. The concrete for the counterweight consists of a mixture of one part of Portland cement, three parts sand, and five parts of broken stone and iron ore. The stone and ore were so proportioned that one cubic foot of the concrete when thoroughly dry weighed 173 pounds.

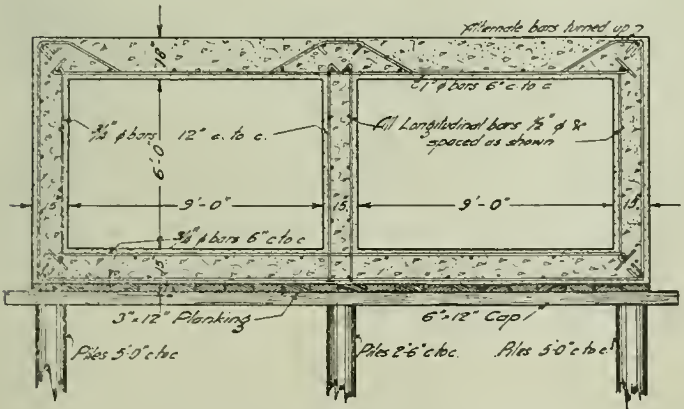
Drainage

Another interesting study in connection with this development work was that of the drainage problem. This consisted not only of making provision for the proper draining of the reclaimed lands, but also in arranging for the extension of the various storm overflow sewers discharging into Toronto Bay or Lake Ontario, between the Humber River and Woodbine Avenue.

One feature which is common to the whole of these extensions is that of the partial or total submergence of the outlets during high water in the lake. Insofar then as the capacity of the storm overflow was concerned, the invert grade was not a factor in the majority of cases. In arriving at the hydraulic grade the maximum Lake level was assumed to be at elevation 248.0, or three feet above zero of the Commissioners' gauge. This elevation is slightly below the maximum high water ever recorded in Lake Ontario; but the assumption was considered a reasonable one in view of the fact that this extreme lake level has been reached only once since 1887.

Drainage Construction.—Western Development.

In regard to the hydraulic grade, the limiting head to which it was assumed the water would be permitted to back up in any extension was such as not to cause flooding. In all the storm overflow sewers for which extensions have been planned the invert grade of the present outlet has been so comparatively steep in every case, and the distance to which the water would back up so proportionately short, that in times of heavy flow, even if the storm water within the sewer rose to an elevation of from six to eight feet above high water level in the lake there would be no danger of it backing up far enough to cause damage through flooding. These comparatively steep inverts made it possible to obtain, without difficulty, such hydraulic grades as to keep the cross sections of the proposed extensions within reasonable limits, even though they were carrying largely increased quantities in many cases.



Cross Section of Garrison Creek Sewer Extension.

The storm water sewers at present in use along the waterfront were designed and constructed to take care of the storm water run-off from certain areas, making what was then considered ample provision for the run-off from future additions to these areas. However, the growth of the City beyond the limits then estimated and a readjustment of the areas drained, will necessitate increasing the capacity of some of these overflow sewers at some time in the not distant future. The extensions so far designed and constructed in connection with the waterfront development are of such cross section that, with the hydraulic grade available, they are of ample capacity to take the increased flow arising from the new conditions.

In the larger extensions, rectangular sections were chosen on account of the facility of their construction, and in all cases the portion passing through newly made ground was built on pile or crib foundations. In cases where these extensions passed through districts any part of which, at some time, might be required for railway purposes, it was considered necessary to design the section to carry E–50 railway loading.

Progress

The situation created as a result of the Great War has naturally retarded the work of the Commissioners, and while progress has not been as rapid as was planned prior to 1914, yet the condition today of the Commissioners' undertaking may be considered as very satisfactory, taking into consideration the unsettled conditions which have obtained during the greater portion of the time since the inception of the work.

Eastern Harbour Terminals

This district, formerly known as Ashbridge's Bay, is probably farther advanced than any other portoin of the development, due to the fact that it is largely industrial and was therefore, not curtailed during the period of the War.

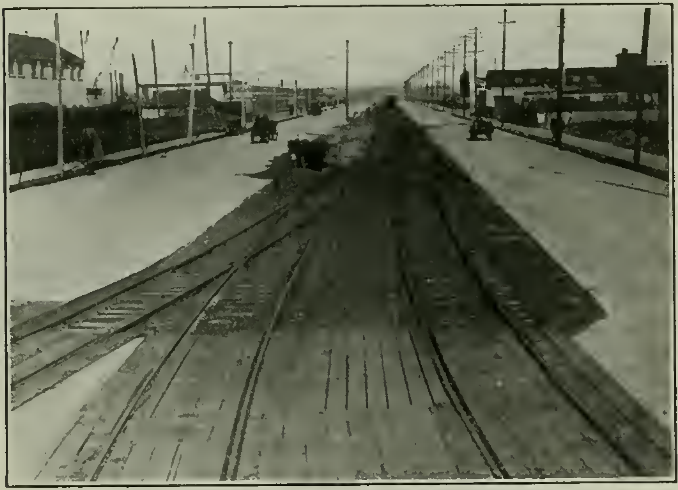
Contracts were awarded by the Federal Government for the retaining walls in this district in October 1913.

The work was divided into three sections, A. B. and C. Section A. consisted of the Eastern Seawall, 17,295 feet in length, extending along the Lake front from the Eastern Channel to Woodbine Avenue, to be built of pile foundation with concrete superstructure. Section B. included the Ship Channel, Turning Basin, Circulating Channel and the dredging of same. Section C. covered the construction of the retaining walls in Keating's Channel and the Marginal Way wall and the Polson Extension.

Under this contract the Ship Channel, Turning Basin and Marginal Way walls, and the retaining walls in Keating's Channel, have all been completed and amount to a total of 23,600 lineal feet.

The reclamation of the areas within the confines of these retaining walls was commenced in June 1914 and since that time there have been deposited approximately 9,800,000 cubic yards in this area. In addition to the above, the Government contractors removed about 3,150,000 cubic yards from the Ship Channel, this total yardage resulting in the reclamation of approximately 450 acres of lands for industrial purposes in this district, and 36 acres of lands for park purposes.

As the reclaimed lands became stable, streets were laid out and improvement made thereon. To date there are two and one-half miles each of paved streets, sidewalks and storm water sewers, and five miles of railway sidings. In addition to the drainage above mentioned, it has been necessary to provide for the City of Toronto storm overflow sewers formerly discharging at the foot of Booth, Logan, Morse and Carlaw Avenues. These have been carried across the district in one large outlet, discharging into the Turning Basin at the foot of Carlaw Avenue.



A New Street on Reclaimed Land.

At the present time the district is being served by The Canadian National Railways, and it is ultimately the intention to make connection with all railroads under an agreement which will provide free interswitching to all industries located in the new area. Siding accommodation is provided to every industry upon payment of the cost of the perishable materials and the labour used in construction, and an annual rental equivalent to six per cent., upon the cost of the rails and fastenings, the ownership of which is retained by the Commissioners.

The concrete roads built in this district, some of them in use for four years, are giving splendid service and show little sign of wear. If, however, in the future they are not suited to the increasing heavy traffic, they are so designed as readily to permit of being surfaced with a better wearing material.

Water mains carrying City domestic pressure are laid throughout the district, and are connected with standard fire hydrants spaced at regulation intervals, providing the same fire protection as in other portions of the City, except within the high pressure area.

The Strauss Bascule bridge, erected over Keating's Channel at Cherry Street, has now been in operation two years, and has given splendid satisfaction. The operating costs have not exceeded the estimates and the general wear and tear has been very small.

In the majority of streets in the district, boulevard strips have been provided inside the sidewalk. These strips vary in width from eight to twelve feet. Fifteen hundred Lombardy poplar trees have been set out in these areas, and seem well suited to the sandy soil.

Of the total area of 450 acres reclaimed, 90 acres have been leased to twenty-one industries and 122 acres are under short term options. These leases are all based on a rental per annum of five per cent. of the value of the lands. The leases are for twenty-one year terms and are practically renewable in perpetuity. In case of cancellation of the lease at the end of any period, the lessee is amply protected.

Central Harbour Terminals

While the transfer of the various properties by the City to the Commissioners gave the latter full control of the waterfront East and West of the inner Harbour, a very small proportion of the property fronting on the Bay between Bathurst Street and Cherry Street was owned by the City at the time of the transfer. It was this circumstance that made it impossible to include in the general scheme of development, prepared by the Commissioners in September 1912, any comprehensive plan for the development of the inner Harbour. Subsequently negotiations were opened with the Railway Companies for the acquisition of the riparian rights of the properties under their control between Bathurst Street and York Street. These negotiations finally terminated in the Railway Companies agreeing, in return for certain considerations, to renounce all riparian rights attached to their properties.

On a petition from the Commissioners, the Federal Government then passed an Order-in-Council extending the Harbourhead line between Bathurst Street and Yonge Street, a maximum distance of approximately 1,100 feet into the Bay, and plans were prepared and approved for the construction of these walls.

Generally speaking, the development provides for the construction of slips 200′ x 600′, with piers of varying width between. The 480-foot strip between the old pierhead line and the new bulkhead line is laid out in building sites, intended for light loft type manufacturing and warehouse buildings, with ample provision for streets and railway accommodation.

Construction work on the Harbourhead walls, which was commenced in 1916, was carried as far as York Street last year, and the portion between York Street and Yonge Street was under construction this year and could have been completed had it not been for the delay in the delivery of stone, due to car shortage. The total length of wall constructed and under construction is 14,500 lineal feet.

The reclamation of the area behind the Harbourhead walls was commenced in 1917, and to date approximately 3,930,000 yards of sand have been dredged from the inner

Harbour, and with it an area of 58 acres have been completely reclaimed and 47 acres partially reclaimed. Of this area 27 acres have been leased, or are under short term options. At the foot and immediately to the West of Bathurst Street 1,425,000 cubic yards of material have been placed, resulting in the reclamation of 18 acres for park purposes and aquatic sites.

Fleet Street, connecting Bathurst Street and Cherry Street along the waterfront, has been laid out and storm water drainage constructed as far as John Street. Water mains have also been laid, giving ample fire protection to the industries already located there. Spadina Avenue storm overflow sewer has been extended from the old outlet to the new bulkhead line, and the high pressure fire intake has been extended to the new John Street slip.

At the present time this district is served by both the Canadian National Railways and the Canadian Pacific Railway, the switching of all cars being under the jurisdiction of the Commissioners. 2.4 miles of Commissioners' tracks have been laid in this district in addition to private sidings.

Park and Recreational Development

When contracts were awarded by the Federal Government for the necessary retaining walls in the Eastern Harbour Terminals, a contract was awarded at the same time for about 20,000 feet of breakwater, extending from the Humber River to the Western Channel about 300 feet from the shore. The object of this structure was to prevent erosion of the beach, provide a protected waterway for small craft, and to raise the temperature of the water behind it for bathing purposes. Approximately 4,600 lineal feet of this breakwater is now completed, and the contract is still in progress. In addition to the above breakwater, there have been constructed 760 lineal feet of sheet piling retaining wall at the mouth of the Humber River and 1,585 lineal feet of crib retaining wall as an extension to the Exhibition sea wall in front of Stanley Barracks' grounds. Dredging to the extent of 4,112,000 yards have been completed, resulting in the reclamation of 106 acres of land. The development of this area was left largely in abeyance during the War, but during the past year splendid progress has been made. A mile and one-half of 50-foot asphalt drive and 24-foot board walk have been completed, together with the drainage and grading incident thereto. Storm overflow sewers at the foot of Ellis Avenue, Keele Street, Sunnyside Avenue and Roncesvalles Avenue have been extended from the old outlets to the new shore line, and it is the intention ultimately to extend them beyond the breakwater. On the beach just West of Keele Street a bathing pavilion, to accommodate four thousand bathers at one time, is under construction, and when completed will constitute one of the most delightful features of the whole recreational area.

Industrial

In regard to industrial expansion, attention is called to the fact that new industries have already under lease 112 acres of newly reclaimed land and under option 158 acres, and that $8,000,000 have been expended by lessees in buildings and equipment on sites that were marsh and water in 1914.

Plant of Dominion Shipbuilding Co. Limited, Built on Reclaimed Land.

In conclusion, having in mind the conditions brought about by the War and the period of industrial unrest following the cessation of hostilities, the Commissioners feel gratified with the result of the development to date. With the completion of the Chippawa power scheme, Toronto's possibilities from the viewpoint of industrial and commercial expansion are almost unlimited. The revenue of the Commission to date, as above outlined, is yearly increasing and the writer has no hesitancy in saying that on completion of all work as projected, the revenue will be sufficient to amply meet the interest and sinking fundcharges thereof.

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VOL. IV. March 1921 No. 3

Well Done Toronto

Never was the value of close and hearty co-operation more clearly demonstrated, nor has there ever been in the annals of engineering gatherings in Canada a more striking illustration of the result of harmonious work than that shown by the successful gathering concluded last month in the Queen City. The whole Institute is proud of the work done by the Toronto committee, and it must be gratifying to the members thereof to know that their well directed efforts for months previous to the meeting resulted in the greatest gathering of engineers ever held in the Dominion. Nor was the meeting great only in numbers, but in that splendid spirit of fraternity and sociability, which, although it did not always exist, is fast becoming a notable feature of professional meetings of *The Institute*. The influence and prestige of the Toronto members was well shown by the hearty support received from members of the Provincial Government, as well as His Honour the Lieut.-Governor, from the mayor and officials of Toronto, and from the large manufacturing interests whose plants were visited.

Every detail of the arrangements for carrying out the programme had been planned with a commendable degree of forethought resulting in a succession of events that brought forth high praise from all who attended from outside the city, and which should be a source of satisfaction to the Toronto Branch. Every man who thus contributed to this pre-eminently successful meeting, besides the personal satisfaction of work well done, has made himself stronger professionally, has brought himself in closer touch with his fellows, and at the same time, has placed *The Institute* and the profession in general under an obligation to him. While all are deserving of sincere thanks, it is not out of place to mention particularly the work of the students, and no one will forget how greatly the ladies' committee contributed towards the general enjoyment of the gathering.

To the members of the Toronto Branch, and particularly to the committees it is fitting to say that *The Institute* is proud of you and all the work you have done, and may the satisfaction that you were responsible for the greatest engineering gathering yet held in this country be some reward for the energy, and well co-ordinated effort which you maintained in order that such a result be achieved.

Secretary's Western Trip

Last year, owing to the demands on his time at headquarters, it was found impossible for the Secretary to make his usual visit to the Western Branches. Some months ago, assurance was given by the Council that the Secretary's trip would be made this year as soon after the annual meeting as possible, and consequently, arrangements have been made towards that end. Mr. Keith proposes leaving Montreal on March 27th, going to Vancouver without stop, visiting the Branches approximately as follows: Coast Cities, April 1st to 8th: Kamloops, 11th to 12th; Calgary, 14th, 15th and 16th; Edmonton, 18th and 19th; Saskatchewan Cities, 21st to 25th: Manitoba. 27th to 30th.

Visiting Other Branches

The question of members when visiting other branch centres making an effort to get in touch with the officers of the Branch where they may be visiting, has twice come up in Council and the principle heartily approved. It is strongly urged that every member make it a point of paying a fraternal visit to the officers of the Branch at least, should no branch meeting be held at the time. It is further advisable that members should go prepared to address the Branch on some subject dealing with the welfare of the profession. We are just now realizing the great benefit resulting from better acquaintance and closer fellowship, and therefore, every such fraternal visit made by any member will add a further contribution to the solidarity of the profession.

Derogatory Legislation Limited

During the past month a Bill was presented to the Quebec Legislature incorporating an association of forestry engineers, giving them powers which would, if put into effect, have interfered with the rights and privileges now enjoyed by members of the engineering profession. Due to the vigilance of A. R. Decary, M.E.I.C., of Quebec, and the protests made by the president of *The Institute*, and by Dean Adams, Hon. M.E.I.C., of McGill, the noxious clauses were struck out. Unfortunately, the Bill incorporating the association was passed, giving the use of the words "forestry engineer" to some men whom it is believed are not entitled to the appellation.

Promoting Members' Interests

At the meeting of Council held on January twenty-fifth, the following resolution of the Toronto Branch was presented:

> "That whereas it is desirable that the morale of the members of the engineering profession should be maintained at as high a standard as possible,
>
> And whereas it is believed that the E.I.C. can render useful service in this direction by urging employers to recognize more fully the status of the E.I.C. membership,
>
> And whereas it is desirable that members of the E.I.C. should enjoy some advantage over other engineers who are not members.
>
> Be it therefoıe resolved that the Council be respectfully urged to recommend employers, who from time to time require engineering assistants, to give preference to members of the E.I.C. subject to their qualifications being equally satisfactory, and that this policy be given publicity in the "*Journal*".

It was pointed out at this meeting of Council that not only was Council in sympathy with the idea expressed in the Toronto resolution, but that this had been established as a definite policy of *The Institute*, although it had not been made as effective as desirable. At Headquarters this policy has been carried out consistently, and apparently the one point where it has not been made effective is that we have not advertised the fact that within the membership of the E.I.C. there is a body of men capable of filling any engineering position required in the Dominion of Canada, or for that matter, anywhere throughout the world. Our own members are already fairly well imbued with the truth of this, and it is generally recognized to-day that membership in *The Engineering Institute of Canada* gives a standing to an engineer, and on the other hand, practically all members of *The Institute* who are employing engineers have adopted the policy of looking for Institute members as assistants.

What is now most needed is to educate the public to a knowledge of the fact that where engineering services of any kind are required, whether for commission, arbitrations, consulting, executive, down to the initial grades, *The Engineering Institute of Canada* is the body to which they should look for advice and assistance in securing such service. Individual contact of our members with those outside is to-day the greatest means we have, and must continue so until *The Institute* is financially in a position to carry on a campaign of education that will enable us to educate those outside of the profession to a due appreciation of the engineer's value.

Getting Better Acquainted

Although it has been the custom at Headquarters to provide letters of introduction in every case where desired to members moving from one Branch centre to another, a resolution of the Toronto Branch, as presented to the Council of *The Institute*, has resulted in instructions being given that will make action where a member is being transfered from one Branch centre to another, automatic. The resolution of the Toronto Branch is,—

> "That the Council be respectfully requested to institute some arrangement by which members who have occasion to transfer from one local Branch to another, can obtain from the Secretary a letter or card of transfer, and a duplicate be sent by post to the local Branch to which transfer is made."

Arrangements have been made at the Headquarters' office for putting this into effect. This arrangement will facilitate the work of Branch Secretaries in inviting newly arrived members and make it easier for them to get acquainted.

Rebates to Branches are made from Branch list as corrected on the first day of January and the first day of July of each year, and consequently the rebate system will continue as heretofore.

Library Advantages to Members

One of the activities of *The Institute* to which too little attention has been drawn is the library in the Headquarters building. Undoubtedly one of the principal reasons for joining among the younger men is to have available text-books and journals to be consulted when necessary. For years *The Institute* library has been doing a quiet and effective work in this connection for those who care to use its resources.

As announced in the report of the Library and House Committee the work of re-cataloguing the library has now been completed. The new system is numerical, that is each class of engineering is given a definite number, all books on any given subject thus being grouped very conveniently for reference. The very thorough cross-references form a feature of the new catalogue; every book in the library having at least three cards, author, title, and general subject, and frequently four or more cards, should the title indicate more than one general subject. The technical library differs to some extent from the general library in that while a definite book is usually sought in the general library, the engineer is not so much interested in a particular book as to obtain as much information as possible on a special subject; This being the case, the value of an index of the type now in use in *The Institute* Library where all books under a subject heading are indexed together, can very readily be appreciated.

While the text-book is valuable, there is little doubt that the best sources of information for the engineer are the technical journal and the transactions of engineering societies. Most engineers subscribe to one or more technical journals; *The Engineering Institute* at present receives regularly ten Canadian, five British, fourteen American and four French technical journals; of these a large proposition are bound yearly and are available for consultation. The value of these journals to *The Institute* member outside Montreal lies in the Engineering Index, published monthly in the *Journal;* where a reference is noted, the journal required can either be obtained from Headquarters on the payment of the usual deposit or from the Engineering Societies Library in New York. It should be borne in mind by all members that the facilities of this great library have been placed at the disposal of all our members; Dr. Harrison Craver, Director of the Engineering Societies Library, 29 W. 39th St., has frequently aided in the search for information; and in this connection the introduction to the Engineering Index is worth reading.

A source of information as valuable as the technical journals is to be found in the Transactions published by engineering societies both on this continent and in Great Britain. *The Engineering Institute* exchanges Transactions with The Institution of Civil Engineers, The Institutions of Mechanical and Electrical Engineers of Great Britain, the great Founder Societies of the United States, and The Canadian Institute of Mining and Metallurgy. In the Transactions appear the finest papers submitted to the societies, and the attention of members consulting the library at Headquarters has frequently been directed to these Transactions, when in search of information on some special topic. For instance an enquirer interested in harbour works engineering would be directed to the Transactions of the Institution of Civil Engineers; the engineer seeking information on superheater practice is recommended the Transactions of the American Society of Mechanical Engineers and the Institution of Mechanical Engineers.

The key to both technical journals and Transactions is the Engineering Index; all papers of merit published all over the world being listed by a special staff at work in New York. An annual volume is issued summing up the Index for the year; a file of the Engineering Index in this form dating back to is to be found in *The Institute* Library.

It can readily be seem from the foregoing that while *The Engineering Institute* may not boast a very large technical library as regards numbers of text-books, its resources are not restricted when used to the best advantage and that it has great possibilities of service to members.

Annual General and Professional Meeting

Toronto, February 1, 2, 3.

Those who attended the annual meeting of *The Institute* held at the King Edward Hotel, Toronto, generally concede that it was the most successful gathering of engineers ever held in the Dominion. The record attendance, the general enthusiasm and the high tone prevailing at all the functions were very gratifying features of the entire gathering. Another item worthy of mention was the large attendance of the younger men of the profession. A large number of student members from the Faculty of Applied Science, University of Toronto were able to attend on account of Dean Mitchell's kindly dictum that for the days, February 2nd, and 3rd, there would be no lectures in this Faculty. Prof. Haultain's Service Committee included President R. W. Downie of the Engineering Society and a number of equally live and energetic students. Including ladies, the total registration was 786. Of this number 690 were not ladies but mostly energetic members of *The Institute,* 278 being from out of town.

While the meeting might have proven a success from the technical point of view it certainly could not have ranked as a great social success without the presence of the ladies in such goodly numbers. After becoming thoroughly acquainted at the reception Tuesday afternoon, and enjoying the talented programme at the Musicale Tuesday evening, they were eager to avail themselves of the entertainment so thoughtly planned for them on the succeeding days. The visits on Wednesday afternoon to Hart House, University of Toronto, the Royal Ontario Museum and the Museum of Household Science proved most enjoyable to all those who attended. After the success of the foregoing events it was not surprising that so many ladies took advantage of the drives on Thursday afternoon. Having visited the Grange Art Gallery the parties proceded to Casa Loma where Lady Pellatt received them in her beautiful conservatory. Leaving Casa Loma they enjoyed a reception tendered by Mrs. Clark at Government House. A number of prominent members of *The Institute* availed themselves of the opportunity of accompanying the ladies and paying their respects to the Lieutenant Governor and Mrs. Clark.

The luncheons on Tuesday and Wednesday were well attended, and the discussion on Legislation was followed with deep interest. The smoker on Tuesday was one of the big events of the meeting, and the variety of entertainment provided was thoroughly appreciated by every person.

The annual banquet upheld the best traditions of *The Institute* and could be justly classed as the outstanding function of the meeting. The presence of His Honour, the Lieutenant Governor of Ontario and so many distinguished guests was a fitting tribute to the high esteem enjoyed by the Engineering profession. The guest of the evening was E. W. Beatty, president of the Canadian Pacific Railway, and his speech was reported at some length in the February issue of *The Journal.* Mr. Beatty's speech

Lt.-Col. H. J. LAMB, M.E.I.C., Chairman, General Committee, Annual General Meeting, 1921

was one of those events which made even those old timers of *The Institute* who have attended so many of these functions, declare that this banquet surpassed anything attempted at previous meetings. All the speeches deserve mention, for they were listened to with keenest attention and were warmly applauded, but that wonderful flow of oratory that fell from the lips of Monro Grier, K.C., who replied to the toast of the Engineering Profession, deserves special mention. The fact that this toast was proposed by an engineer, Brig.-Gen. C. H. Mitchell, M.E.I.C., and responded to by a lawyer, gave both speakers an opportunity of commenting with some humour on this unusual procedure.

Many took advantage of the various excursions on Wednesday afternoon. This was particularly true in the case of the trip to the plant of the Baldwin's Canadian Steel Corporation at Ashbridge's Bay, which also presented an opportunity for visiting members to view a small portion of the vast harbour development now under construction.

A new feature of the meeting which thoroughly justified itself was the sectional division for the presentation of technical papers. The attendance at the sectional sessions taxed the accomodation to the limit and, in the case of the Municipal section an adjournment had to be made for a further session. The general papers illustrated by motion pictures and lantern slides were not to any extent lessened in their popularity by reason of the sectional meetings.

As a fitting climax to the whole meeting, the Dance given at Hart House under the auspices of the Engineering Society, University of Toronto was an event of it's kind which would be hard to surpass. The thanks of *The Institute* is due to President R. W. Downie, S.E.I.C., and his associates of the Engineering Society for their extreme courtesy in inviting the members of *The Institute* to join them at this most enjoyable function.

Professional Meeting

Chemical Engineering Section.

"Chemical Engineering in the Packing House"

T. L. Crossley, A.M.E.I.C., was in the chair with J. R. Donald, B.A.B.Sc., chemical engineer of the Canadian Packing Company, read a paper on "Chemical Engineering in the Packing House." The following took part in the discussion:—

F. W. Thorold, M.E.I.C., who further described the Bannon Separator, explaining the difficulty in connection with "Floaters", which formed an intermediate layer between the water and the oil. These consist of particles containing so much oil that they were rendered lighter than water, but did not rise through the oil owing to their content of scraps.

L. T. Acton, M.E.I.C., of the William Davies Company, who also spoke of the difficulties in the separation of fat from water, and discussed some points in connection with pharmaceutical products.

Mr. Donald replying to questions by the Chairman referred to the developments along pharmaceutical lines.

"Hydrated Lime"

Lucius E. Allen, M.E.I.C., consulting chemist of Belleville, Ont., then read a paper on "Hydrated Lime as an Engineering Material."

In connection with these papers, the meeting was favoured with a number of slides, shown by Major L. H. Hart of the National Lime Association, Washington, B.C., illustrating the manufacture and uses of hydrated lime. Major Hart also made remarks with a special reference to the question of plasticity in the use of hydrated lime,

H. L. SEYMOUR, A.M.E.I.C., Secretary, General Committee, Annual General Meeting, 1921

W. A. BUCKE, Chairman,
Finance Committee, Annual General Meeting, 1921

showing in several slides a clean cut effect, attributed to hydrated lime in adequate proportion in concrete aggregates. In addition several slides were shown with reference to manner of testing aggregates for plasticity.

Professor J. Watson Bain, President of the Canadian Institute of Chemistry was present, and on being introduced by the Chairman, referred to the question of analysis of limes, objecting to the custom which now prevails of reporting all the calcium in an analysis as calcium oxide, though some of it might be present in the form of silicates, or other compounds, especially unburned carbonates.

Professor E. G. R. Ardagh, discussed the difficulties in connection with the slaking of high magnesia lime and its uses.

Major Hart in reply said that the question of slaking was unfortunately one that had been left very much in the hands of ignorant labor, and definite scientific observations were lacking. In reply to Professor Ardagh, he said that magnesia limes were more plastic, and made somewhat stronger mortar.

The meeting then adjourned.

Mechanical Engineering Section.

Under the chairmanship of C. B. Hamilton, M.E.I.C., the Mechanical Section held a successful and interesting section at which several valuable papers were read, all of which brought out animated discussion. The papers read at this meeting: "Control of Corrosion in Steel Mains", by F. N. Speller, metallurgical engineer, National Tube Company, Pittsburgh; "Recent Researches on Aeroplane Wing Type", by J. H. Parkin, University of Toronto, with accompanying discussion are being held for the April number of *The Journal.*

Municipal Engineering Section.

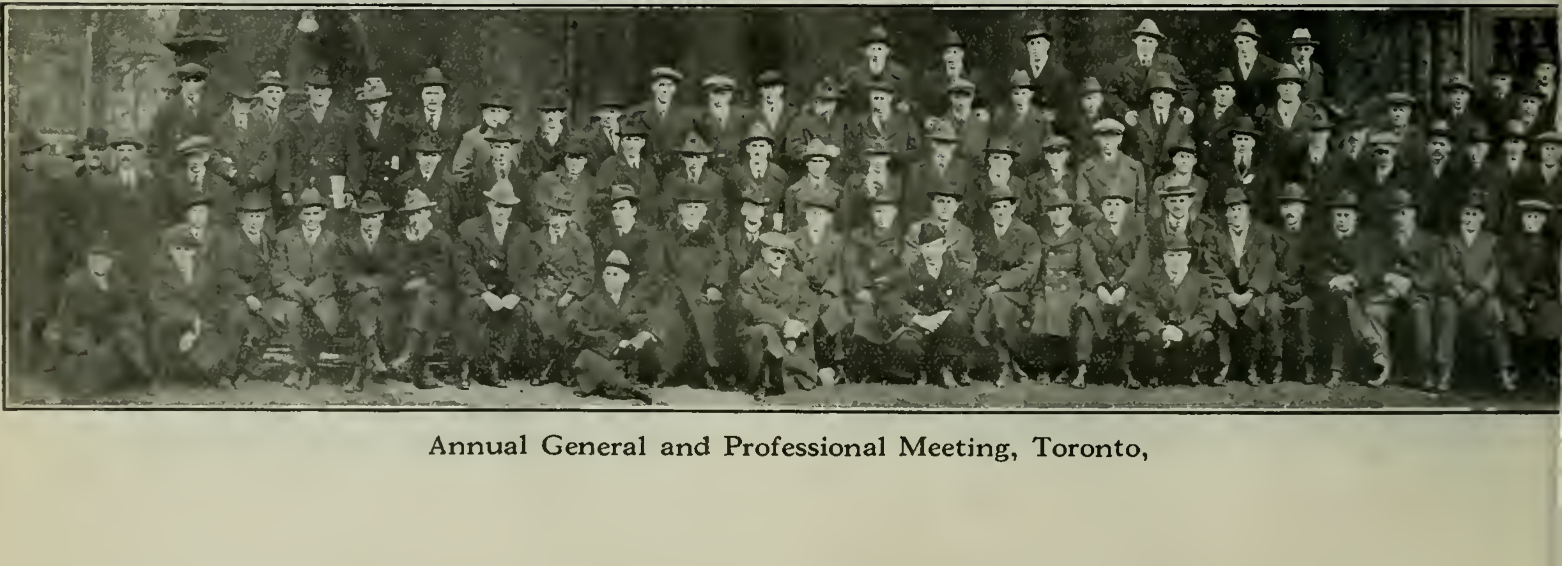
At the meeting of the Municipal Section, R. O. Wynne-Roberts, M.E.I.C., in the Chair, the following paper were taken as read, having been printed in *The Journal* and being available for all present in the form of advance proof. The fact that the papers had been printed opened the meeting at once to discussion, the first paper being that of the Chairman on "Municipal Engineering".

"Municipal Engineering"

James Milne, M.E.I.C., in discussing the paper paid particular attention to the section dealing with metering, and particularly criticized the statement that metering would help to reduce the daily per capita water consumption in Toronto to 80 gallons. Others who took part in the discussion on this paper were D. A. R. McCannel, A.M.E.I.C., and C. Wm. Gore, M.E.I.C.

"Design of a Sewage Disposal for a City located on "Tidal Waters"

The next paper presented to the meeting was that of C. J. Yorath, A.M.E.I.C., on "Design of a Sewage Disposal Plant for a City Located on Tidal Waters",



Annual General and Professional Meeting, Toronto,

H. E. T. HAULTAIN, M.E.I.C., Chairman,
Service Committee, Annual General Meeting, 1921

and in this case it seemed the consensus of opinion that the formulae and coefficients quoted, while applicable to British conditions would require change to be suitable in Canada. Among those joining in the discussion were George Phelps, A.M.E.I.C., R. R. Knight, M.E.I.C., Hector Philips, A.M.E.I.C., and J. M. Greig, A.M.E.I.C.

"Cost-Plus Contracts"

Following the discussion on Mr. Yorath's paper came that of J. Clark Keith, A.M.E.I.C., on "Cost-plus Contracts", which aroused interesting comment from engineers present. The cost-plus method of contracting is a live subject and the opinion of the meeting was fairly evenly divided on the subject, judging from the comment on Mr. Keith's paper. Alexander Potter, M.E.I.C., of New York discussing the cost-plus method favoured the unit-price method for municipal work, the cost-plus method for private work. R. L. Dobbin, M.E.I.C., spoke against the cost-plus method, giving examples from the municipal experience of Peterborough, for which city he is superintendent of waterworks. Replying to the discussion Mr. Keith stated that the crux of the whole situation in regard to the cost-plus method of awarding contracts lay in the integrity of the contractor.

"The Activated Sludge Process of Sewage Disposal"

Discussion on Dr. G. G. Nasmith's paper "The Activated Sludge Process of Sewage Disposal" was adjourned until the afternoon session, following a short comment by Willis Chipman, M.E.I.C. The first speaker was F. A. Dallyn, A.M.E.I.C., who took exception to the limitation of the Activated Sludge Process to larger towns, giving instances from his own experience of several installations in Ontario. He referred to possibilities in cost reduction, and touched on the problems of sludge disposal and possible fertilizer value of sludge. I. H. Nevitt, M.E.I.C., following Mr. Dallyn gave figures from the Morley Avenue disposal plant in Toronto, the average quantity for two years having been three and one third yards per million gallons at a water content of 80—85%., (Imhoff Tank); he referred also to experiments at Milwaukee and Houston. James Redfern quoted interesting figures for an activated sludge system installed for Newmarket, Ont., the tender for a plant handling 200,000 gallons a day, having a six hour period of aeration, and a maximum capacity of 500,000 gallons per day, having been $31,000.

After a brief reference by Alex. Potter, M.E.I.C., to the Houston plant, Wm. Gore, M.E.I.C., described experiments designed to overcome two principal difficulties in the activated sludge process, the cost of pumping, and the disposal of sludge. The method proposed was to treat the incoming raw sewage with digested sludge, passing it next to an ordinary activated sludge tank. It was stated that the experiments had been successful in reducing the amount of air necessary by one half, for some periods only seven eights of a cubic foot of air being required per gallon, based on a ten foot depth.

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G. A. McCARTHY, M.E.I.C., Chairman, Technical Papers Committee, Annual General Meeting, 1921

E. M. Proctor, A.M.E.I.C., brought out the point that the principal reason for the selection of the activated sludge plant at Newmarket that this method would avoid the necessity of pumping sewage.

In his reply to the discussion Dr. Nasmith stated that in his paper he had endeavoured to state the facts about the activated sludge process without arguing for or against; he stated that in his opinion the disposal of sludge need not be too great a difficulty for small municipalities. He referred to problems which remain to be solved, particularly in connection with de-watering sludge.

After the discussion on Dr. Nasmith's paper had technically closed, Willis Chipman, M.E.I.C., volunteered information regarding the operation of activated sludged systems in small municipalities. It was his experience that while the process was all that was said in its favour, it was somewhat complicated for the small municipalities, and would need careful supervision. After remarks on the paper by the Chairman, Wm. Storrie, M.E.I.C., suggested that a round-table conference be called to discuss the problem.

"Toronto Filtration Plant"

The next paper on the programme was that of James Milne, M.E.I.C., on "Toronto Filtration Plant", the discussion being both lively and long.

After Mr. Milne's introductory remarks, Allen Hazen, M.E.I.C., of New York, gave particular attention to the items of cost in Mr. Milne's paper, stating it as his opinion that a fair distribution of cost had not been given to the slow sand and drifting sand installations. Figures were quoted regarding bacteria in raw water and effluent for both methods of filtration for the year 1918, the inference being in favour of the slow sand type of filter. F. A. Dallyn, A.M.E.I.C., followed Mr. Hazen and opened a lengthy discussion on the subject of alum and its effects on drinking water. It was stated that residual alum in mains had been responsible for diarrhoea, and this subject was taken up in more detail by Norman J. Howard, bacteriologist in charge of the Toronto Filtration Plant laboratory, who said that no alumina reaction has been found in any mechanically filtered water. The discussion following, in which Messrs. Rust, Gore, Sanderson and Storrie spoke, took the form of a comparison of the slow sand and drifting sand plants at the Toronto Filtration Plant. In his reply to discussion Mr. Milne touched on the comparison of the two plants, and gave some interesting figures regarding the drifting sand plant; which has filtered as high as the rate of 76 million gallons per day under test, and should have a normal capacity of at least 54 million gallons per day.

Structural Engineering Section.

Two papers formed the programme for the meeting of the Structural Section, T. D. Mylrea, A.M.E.I.C., Chairman. "On the Economics of Building Design", by J. Morrow Oxley, A.M.E.I.C., and "Some Features of Specifications for Bridge Construction", by Frank Barber, A.M.E.I.C.

"On the Economics of Building Design"

The discussion on Mr. Oxley's paper was opened by A. H. Harkness, M.E.I.C., who remarked on the advantages of rectangular columns of concrete in certain parts of concrete buildings, and asked for information as to the economics of such sections as compared to the octagonal section. It was Mr. Harkness'

J. B. CARSWELL, M.E.I.C., Chairman, Accommodation Committee, Annual General Meeting, 1921

T. R. LOUDON, M.E.I.C., Chairman,
Entertainment Committee, Annual General Meeting, 1921

opinion that the rectangular column held the advantage on account of the relatively small thickness to be deducted as fire-proofing. Prof. C. R. Young, M.E.I.C., followed with an enquiry regarding the added cost of placing concrete in buildings over seven stories, and was followed by A. W. Connor, A.M.E.I.C., D. C. Tennant, M.E.I.C., L. L. Campbell, A.M.E.I.C., J. A. Knight, A.M.E.I.C., and others, special stress being laid on flat-slab construction. In reply Mr. Oxley favoured the rectangular column particularly for light loads, the hooped column being recommended for high building and heavy loads. He stated the interesting fact that contractors have found very little additional cost in carrying a seven storey building up two or three stories beyond the seven storey height.

"Some Controversial Points in Concrete Specifications"

Mr. Barber's paper on Concrete Specifications drew interesting and favourable discussion. Among the speakers was Prof. C. R. Young, M.E.I.C., who granted many of the objections registered in Mr. Barber's paper against existing specifications. He welcomed the paper as a member of the Canadian Engineering Standards Committee which is at work drafting new standard specifications. Col. H. C. Boyden of the Portland Cement Association made the interesting comment that in his experience much depended on the reputation of the engineer as to the strictness with which he enforces specifications as to the size of tenders, a contractor being inclined to add to his tender where the engineer was suspected of being over-zealous or to cut down for one who is lenient.

Continuation of Professional Meeting.

On Thursday morning the Professional Meeting was continued, the first item being an exhibition of films showing the manufacture of pulp and paper, the films being loaned by the Spanish River Pulp and Paper Co., Ltd., and the Riordon Pulp and Paper Co. Ltd., to whom the thanks of the members is due. The showing of the films was accompanied by an interesting talk on the processes, by T. Linsey Crossley, A.M.E.I.C.

"Queenston-Chippawa Power Development"

An illustrated talk by A. C. D. Blanchard, M.E.I.C., followed on the construction of the Queenston-Chippawa Power Development. This important project has already been described to the members of *The Institute* through the valuable papers presented at the Niagara Falls Professional Meeting held last September, and much interest was shown in the report of progress. Mr. Blanchard in his remarks mentioned that the work is being pushed forward rapidly, and that over 5000 men are now employed on the work. He reported that the excavation for the intake is almost finished, and the power-house is under construction. A film showing the work followed.

"Toronto Harbour Improvements"

Two papers were presented in the afternoon session, the first was that of E. L. Cousins, A.M.E.I.C., on the Toronto Harbour Improvements, ably presented in the absence of Mr. Cousins by Geo. T. Clark, A.M.E.I.C. The discussion that followed was opened by T. D. Mylrea, A.M.E.I.C., who enquired regarding possible damage due to rust in the two inch anchor rods used in wall construction. A. U. Anderson asked for information as to the life of steel sheet piling, M. V. Sauer, M.E.I.C., also made enquiry as to steps taken to protect the outer shore of Toronto Island. Mr. Clark in replying stated that provision had been made for rust corrosion in specifying the two inch rods; that it had been reported in connection with the sheet steel piling that there was no likelihood of corrosive action, and that contracts had already been let by the Federal Government for a breakwater designed to protect the outer shore of the Island.

Mechanical Engineering Section.

C. B. HAMILTON, M.E.I.C., Chairman,
Mechanical Engineering Sectional Meeting

E. T. J. BRANDON, A.M.E.I.C., Chairman, Electrical Engineering Sectional Meeting

"The Mechanical and Electrical Features of the New Toronto Union Station"

Walter J. Armstrong, A.M.E.I.C., then presented his illustrated paper on "The Mechanical and Electrical Features of the New Toronto Union Station". As the reading of the paper brought the meeting to closing time, it was decided to adjourn the meeting without discussion.

Luncheon — Wednesday, February 2nd.

At the Luncheon on Wednesday, Mr. Wynne-Roberts presided and introduced T. L. Church, Mayor of Toronto, who in a brief speech spoke of the many services rendered by engineers in public service, and declared himself as a supporter of efforts for legislation.

Discussion on Legislation.

Following the luncheon Mr. Wynne-Roberts vacated the chair in favour of H. B. R. Craig, M.E.I.C., Chairman of the Ontario Provincial Division, and there followed a most interesting series of talk on engineering legislation in the various Provinces.

British Columbia

D. O. Lewis, M.E.I.C., in discussing the history of legislation in British Columbia described the formation of the "British Columbia Technical Union" the preliminary work on the Bill, and the manoeuvres necessary to have the Bill become an Act.

Alberta

L. E. Drummond, Vice-President of The Association of Professional Engineers of Alberta then gave a brief survey of the working of the Alberta Act. He mentioned the peculiar fact that the penalty clause is not fully protected by the wording of the Act, but that it will become operative through time, and touched on University control.

Saskatchewan

H. G. McVean, A.M.E.I.C., following, drew a picture of the conditions in Saskatchewan which had brought about the failure, to date, of legislation in that province. He attributed this failure largely to lack of educational work among the farmer members who had an incorrect idea, therefore, of the purpose of the Bill.

Manitoba

W. M. Scott, M.E.I.C., in discussing the Manitoba Act, mentioned that the Act passed in 1896, although inoperative on account of the lack of a penalty clause, had been of great value in helping to pass the new Act, particularly in reducing legal expenses. Mr. Scott discussed the age of registration, expressing his opinion that this should be raised to twenty-five from twenty-one. The present membership of the Association of Professional Engineers of the Province of Manitoba is 198, with 250 on the application list.

Quebec

The situation in Quebec was described by Fred. B. Brown, M.E.I.C., Secretary of the Corporation of Professional Engineers of Quebec. Mr. Brown described the change in legislation whereby control had been transferred from *The Engineering Institute* to the new Corporation; he stated that the by-laws under the amended Act were now under consideration by the Provincial Cabinet, and it is expected to have these in force shortly.

New Brunswick

According to F. B. Fripp, A.M.E.I.C., New Brunswick has been more fortunate than the Western Provinces in that very little difficulty was experienced in passing the Act which became effective in 1920; eighty per cent of the engineers qualified to register have taken the necessary steps, and the remaining twenty per cent are expected to join the fold within a short time.

Nova Scotia

K. H. Smith, M.E.I.C., paid a warm tribute to C. E. W. Dodwell, M.E.I.C., the pioneer of engineering legislation in Nova Scotia and briefly described the Nova Scotia Act. A noteworthy feature of the Act is that the Council is partly elected by the Members of the Association, partly by the Lieutenant-Governor-in-Council. Mr. Smith expressed his satisfaction with registration in the Province, and concluded his remarks with a suggestion for future discussion as to the relation of *The Engineering Institute* with the Provincial Associations of Professional Engineers.

Ontario

F. R. Ewart described the legislation situation in Ontario. Mr. Ewart gave details of the spade work that has been necessary in the preparation of the Bill, and declared his satisfaction with the remarkable uniformity of opinion on the Bill as finally drafted. Mr. Ewart stated that it would now be impossible to have the Bill submitted at the present Session of the Ontario Legislature as a Private Bill, but that there was a possibility of the Bill being submitted as a Public Measure. In conclusion Mr. Ewart appealed for the earnest consideration and help of every engineer in Ontario to assist the Advisory Conference in its difficult work.

Canadian Engineering Standards Association Committee

The following Report of the Canadian Engineering Standards Committee was received at the Annual Meeting. The Report gives an outline of the work of the Canadian Engineering Standards Association together with the personnel of the officers of the main Committee.

The President and Council,

Your Committee desires to present the following report to *The Engineering Institute* as to the activities of the Canadian Engineering Standards Association for the year 1920:

Officers of the Association

These remain as in our last report,—

Chairman—Sir John Kennedy, M.E.I.C.

Vice-Chairmen {H. H. Vaughan, M.E.I.C.
T. A. Russell.

Honory Secretary-Treasurer—Dr. J. B. Porter, M.E.I.C.

The above form the Executive Committee.

Secretary—R. J. Durley, M.E.I.C.
112 West Block, Ottawa.

Main Committee

Certain changes have taken place in the membership of the Main Committee, which is now as follows:—

Chairman: Sir John Kennedy, M.E.I.C., Harbour Commissioners, Montreal;

Lt.-Col. W. P. Anderson, M.E.I.C., C.M.G., Dept. of Marine, Ottawa;

Prof. J. Watson Bain, University of Toronto;

A. Boyer, A.M.E.I.C., consulting engineer, Montreal;

K. M. Cameron, A.M.E.I.C., Dept. of Public Works, Ottawa;

Dr. E. Deville, Dept. of the Interior, Ottawa;

A. A. Dion, M.E.I.C., Ottawa Electric Co., Ottawa;

G. H. Duggan, M.E.I.C., Dominion Bridge Co., Montreal;

Dr. A. S. Eve, F.R.S., McGill University, Montreal;

J. M. R. Fairbairn, M.E.I.C., Canadian Pacific Rly., Montreal;

Walter J. Francis, M.E.I.C., consulting engineer, Montreal;

F. A. Gaby, M.E.I.C., Hydro-Electric Commission of Ont., Toronto;

A. R. Goldie, Goldie & McCulloch, Ltd., Galt;

Prof. L. W. Gill, M.E.I.C., Dept. of Labour, Ottawa;

Sir J. Geo. Garneau, National Battlefields Commission, Quebec;

Dr. J. H. Grisdale, Dept. of Agriculture, Ottawa;

Prof. P. Gillespie, M.E.I.C., University of Toronto;

Robert Hobson, M.E.I.C., Steel Company of Canada, Hamilton;

Dr. L. A. Herdt, M.E.I.C., McGill University, Montreal;

R. E. Jamieson, Dominion Rubber Co., Montreal;

H. G. Kelley, M.E.I.C., Grand Trunk Railway Co., Montreal;

Lt.-Col. W. J. Keightley, Dept. of Militia & Defence, Quebec;

Lt.-Col. C. N. Monsarrat, M.E.I.C., Dept. of Railways & Canals, Ottawa;

J. G. Morrow, Steel Company of Canada, Hamilton;

G. A. Mountain, M.E.I.C., Board of Railway Commissioners for Canada, Ottawa;

Prof. H. M. Mackay, M.E.I.C., McGill University, Montreal;

A. B. Macallum, F.R.S., Research Council, Ottawa;

D. H. McDougall, M.E.I.C., Nova Scotia Steel & Coal Co., New Glasgow, N.S.;

Dr. J. C. McLennan, F.R.S., University of Toronto;

Lt.-Col. G. Ogilvie, Dept. of Mines, Ottawa;

Eng.-Commander T. C. Phillips, M.E.I.C., Dept. of Naval Service, Ottawa;

Dr. J. B. Porter, M.E.I.C., McGill University, Montreal;

J. B. Reade, Purchasing Commission of Canada;

T. A. Russell, Willys-Overland of Canada, Toronto;

R. A. Ross, M.E.I.C., Consulting Engineer, Montreal;

J. Stadler, Belgo-Canadian Pulp & Paper Co., Shawinigan Falls, P.Q.

Lt.-Col. E. W. Stedman, The Air Board, Ottawa;

A. Surveyer, consulting engineer, Montreal;

T. F. Sutherland, Dept. of Mines, Toronto;

Dr. A. Stansfield, M.E.I.C., McGill University, Montreal;

A. F. Stewart, M.E.I.C., Canadian National Railways, Moncton, N.B.;

W. F. Tye, M.E.I.C., consulting engineer, Montreal, and

H. H. Vaughan, M.E.I.C., consulting engineer, Montreal.

Sectional and Sub-Committees

These committees carry out the technical work of the Association, and up to January 1st, 1921, ten sectional committees and sixteen sub-committees have been organized. A summary of their work follows:

Sectional Committee on Aircraft Parts

This Committee was approved by the Air Board (Dominion Government) on February 14th, 1920, as the Canadian representative committee forming part of the International Aircraft Standards Commission. Little technical work has so far been accomplished in this connection, however, as the whole status of the I.A.S.C. and its relation to any technical committees which may be appointed by the International Commission for Air Navigation (under Article 34 of the Convention for the Regulation of Aerial Navigation) is now under discussion in London, and modifications in the constitution and functions of the I.A.S.C. may result.

A request has been received from the Air Board to arrange, if possible, for the preparation of specifications for certain aircraft materials in the form in which they can be most satisfactorily obtained under commercial conditions now existing in Canada. Preliminary work looking to the organization of Panels for this purpose is being carried on.

Electrical Sectional Committee

Sub-Committee on Canadian Electrical Code. At the fourth meeting of the Main Committee, the formation of this Sub-Committee was approved, and, on the recommendation of the Electrical Sectional Committee, it was decided that its first task would be to arrange for the preparation of specifications relating to the proper construction, methods of testing and approval of appliances, fittings and materials used in connection with interior electrical installations, such specifications to be framed with full regard to the opinions of the various provincial and other bodies having jurisdiction, and to be based as far as possible on existing documents of this kind having wide acceptance. This important Sub-Committee will naturally be a widely representative one and progress is being made with its organization.

Sub-Committee on Incandescent Lamps. A draft specification has been prepared for consideration at the next meeting of the Sub-Committee, but in view of the fact that important changes are just now being made in the specification generally accepted in the United States, it is felt that information as to these changes should be awaited before proceeding further.

Sub-Committee on Transformers (Distribution Type). The first report of the Sub-Committee on Transformers has been authorized for publication and is now in the Press under the title of "C.E.S.A. Requirements for Standard Single-phase Distribution Transformers."

Sub-Committee on Station Type Transformers. Considerable progress has been made with the collection of preliminary data and information looking to the preparation of a similar document as regards station type transformers.

A Panel of the Sub-Committee is preparing a report on Impedance, as it affects the specifications for transformers.

Sub-Committee on Telegraph and Telephone Wire. Agreement having been obtained among the representatives of the various purchasing and manufacturing bodies, resulting in the selection of two grades of this material as standard, namely, 5000 and 5600 mile-ohm wire, specifications have been prepared and approved by the Electrical Sectional Committee. They are now before the Main Committee for final approval and will, it is anticipated, be published shortly.

Sub-Committee on Watthour Meters. This Sub-Committee is now organized and preliminary information and data are being gathered. It is intended to prepare specifications for these meters, together with the necessary transformers, which will have as general acceptance as possible, and will cover such points as standard methods of testing, degree of accuracy to be called for, standard arrangement of dials, and the like.

Sub-Committee on Wood Poles for Transmission Lines. This Sub-Committee is being organized and preliminary information collected, the producers being represented by gentlemen named by the Canadian Lumbermen's Association. It is hoped to prepare specifications for various grades of poles which will be generally acceptable and will at the same time be in accord with the limitations now imposed by commercial considerations.

Sub-Committee on Standard Ratings and Tests of Electrical Machinery. This Sub-Committee is being organized with the view of making recommendations regarding the various rules for this purpose which are now being generally worked to in Canada, such as those of the American Institute of Electrical Engineers, the Electric Power Club, the National Electric Light Association, and so on, but which have so far not been accepted or adopted by any responsible Canadian technical body and have, therefore, no official status in this country.

Sectional Committee on Rails and Track

Two meetings of this Committee have been held, and progress has been made in the selection of standard rail sections for adoption by the engineering departments of all Canadian roads. When this question has been dealt with, the matter of rail specifications will be taken up.

Sectional Committee on Wire Rope

A draft specification for this material has been prepared for criticism, and, together with the members' comments on same, will shortly be considered at a joint meeting of the two sub-committees, that on Wire Rope for Mining Purposes, and that on Wire Rope for Dredging and Steam Shovel Work.

Sub-Committee on Wire Strand. Information has been collected regarding specifications now in use and preparations are being made for the first meeting of the Sub-Committee.

Sectional Committee on Steel Bridges and Construction

Sub-Committee on Steel Railway Bridges. The Specification drawn up last year by this Sub-Committee was issued in September. It is of course based upon the E.I.C. Specification of 1918, which was referred by the Council of the E.I.C. to the Association for action in May, 1919.

Sub-Committee on Steel Highway Bridges. This Committee is engaged in similar work in connection with the E.I.C. Specification on Steel Highway Bridges. A draft of the revised specification has been prepared and will be considered at the first meeting of the Sub-Committee, which it is hoped to hold in February.

Sectional Committee on Mining Machinery

An invitation has been received from the American Engineering Standards Committee to co-operate as far as possible in the standardization work being carried on in the United States as regards mining machinery.

The Chairman of the Sectional Committee is in communication with the officers of the American organizations in this connection.

Sub-Committee on Drill Chucks and Steel. Information regarding the many divergent styles of equipment used in the various mining districts in Canada is being collected for consideration at an early meeting of the Sub-Committee.

Sectional Committee on Steel

Special Committee on Material for Steel Forgings. The Chairman of this Special Committee has made a study of the various specifications for material for steel forgings now being worked to in Canada (over thirty in number) and preliminary correspondence is being carried on. The prospects, however, of obtaining agreement among all concerned as regards specifications for a series of standard grades of material for steel forgings do not appear at present very favourable.

Sectional Committee on Cement and Concrete

Sub-Committee on Cement. This Sub-Committee is actively engaged in the revision of the E.I.C. Specification for Portland Cement and a draft of the revised specification is now ready for consideration at a meeting of the Committee.

Further work is being planned in connection with specifications for reinforced concrete, and it is proposed to form a joint Panel with the Sectional Committee on Steel to deal with the question of specifications for steel reinforcing bars, requests for which have been before the Main Committee.

British Engineering Standards Association

The B.E.S.A. continues generously to furnish the C.E.S.A. with a stock of their publications as they appear, and these are available for distribution at a nominal charge at the Secretary's Office.

American Engineering Standards Committee

Several requests for co-operation have been received from the A.E.S.C. in addition to the one in connection with mining machinery already referred to. Among these may be mentioned:

Formulation of safety code for logging and sawmill machinery;

Standardization of ball bearings, and

Standardization of passenger and freight elevator equipment.

In all these cases the Executive Committee is in communication with the various Canadian bodies concerned.

Foreign Standardization Bodies

Copies of the following engineering standards issued by Foreign national standardizing bodies are on file with the C.E.S.A.:—

Association Belge de Standardisation (Belgium).

No. 1. Construction of Metal Framework, Rules for
No. 2. Construction of Metal Tanks, Rules for
No. 3. Construction of Coverings and Partitions of Corrugated Galvanized Sheet-iron, Rules for
No. 4. Shafts and Transmission Pulleys, Standardization of
No. 5. Construction of Metal Bridges, Rules for

Sveriges Maskinindustriforening (Sweden).

SMS—1. Standard sizes for Drawings
SMS—2. Metric Screw Thread System;
SMS—3. Whitworth Screw Thread System;
SMS—5. Hexagonal Nuts-Type BGM-BSW Screw Thread System
SMS—7. Finished Hexagonal Screws-Type BGS-BSW Screw Thread System
SMS—8. Series of Standard Diameters
SMS—10. Standard dimensions for Conical Taper Pins
SMS—11. Standard dimensions for Woodruff Keys.

Commission de Normalisation du VSM (Switzerland).

VSM—10300 to VSM—10307 Technical Drawings—Oblique Script; Size of Letters; Graphic Presentation of Screw; Cross Sections.
VSM—12050 Whitworth Screw Threads; General data
VSM—33900 to VSM—33914 "Sulzer" Attachment for Milling Cutters.
VMS—12000 Whitworth Threads
VMS—12001 Whitworth Threads
VSM—15000 Standard diameters to be employed

Hoofdcommissie voor de Normalisatie in Nederland (Holland).

N—5 Shaft diameters, numbers of revolutions and distances of bearings for Mill Gearing;
N—6 Power transmitted with standard numbers of revolutions;
N—7 Weight, lengths, and tolerances for shafts for mill gearing;
N—8 Keys, Standard dimensions of
N—9 Keys, Standard dimensions of
N—10 Taper Pins, Standard dimensions of
N—11 Standard diameters of Shafting;
N—13 Standard scales for Technical Drawings;
N—14 Standard sizes for Workshop Drawings
N—15 Standard Sizes for Workshop Drawings
N—16 Tolerances, Standard Definitions for
N—17 Tolerances, Standard Definitions for
N—18 Tolerances, Standard Definitions for
N—19 Compression Couplings
N—20 Flange Couplings
N—21 Gauge Telerances;
N—22 Gauge Tolerances;
N—24 Technical Drawings
N—25 Technical Drawings
N—26 Technical Drawings
N—27 Technical Drawings
N—28 Technical Drawings
N—28 Technical Drawings
N—29 Standard dimensions for Loose Collars
N—30 Standard dimensions for Loose Collars
N—42 Gauge Tolerances
N—43 Gauge Tolerances

Copies on file may be consulted at the Association's Office, Room 112, West Block, Ottawa.

Respectfully submitted,
H. H. VAUGHAN.

Committee on Uniform Steam Boiler Specifications

The following report was received at the Annual Meeting.

The President and Council.

The Committee begs to report as follows on the progress made during the past year in having uniform boiler regulations adopted by the different Provinces of the Dominion.

The regulations which the committee recommended in their last report as being suitable for the whole Dominion have been amended in some minor particulars, and are now being printed in pamphlet form.

These regulations have already been adopted by the Provinces of Alberta and Manitoba and it is expected that they will be adopted by Saskatchewan within a month.

In Nova Scotia a bill has been passed by the Legislature approving of their adoption and awaits the signature of the Governor to become law.

In British Columbia and Ontario legislation has been somewhat delayed by elections and changes in the Government but it is expected that these provinces will adopt the new Regulations very shortly.

With such a beginning the Committee is hopeful that in a comparatively short time all the Provinces will be in line on this question.

Respectfully submitted,

L. M. Arkley,

Chairman.

Retiring President's Address*

R. A. Ross, M.E.I.C.

When in the course of society events, the President of *The Institute* lays down his office, divests himself of his robes, his staff and his mitre, and departs to the limbo of past presidents, leaving his pontifical blessing, and his portrait behind in the Vahalla of *The Institute* as a last remembrance, the ritual of the occasion demands of him a swan song, the usual chorus from the audience being "How long, O Lord, how long!"

On this occasion, as practically always, the theme is "Engineering" and "*The Engineering Institute of Canada*", and your chorus, let us all hope, will not require frequent repetition during the recital.

When the last presidential selection was made by a misguided committee and eventually confirmed, through lack of any other alternative, by the ballot of the membership of the Society at large, the loom of the present meeting with its inevitable address on Institute matters overspread the presidential horizon.

But slowly there came light, with a realization of the fact that there was enough successful accomplishment in the history of *The Institute* during its thirty-three years of life to warrant a summing up of past effort and results, and a projection of the curve of the past into the future, with some certainty that the sound principles which have guided the past will operate similarly in the future, while the inefficiencies of the past will serve as warnings.

Apart from purely Institute matters, also, the general field of engineering has taken on a form and substance which makes it possible to prophesy, with some certainty, as to the general future of the profession or at least as to its general trend.

World Re-adjustment

World tendencies are slowly taking visible form after the recent upheaval, and, barring a crisis, now fortunately receding, which would wreck civilization, the shaking-down process will operate to provide such stability in a few years that world matters can proceed on some basis of confidence.

Whether our present industrialized civilization is the best or not is beside the question, for it is here, and if we can see no other system which will take its place, it must perforce be rehabilitated and go on to greater lengths until it breaks, or be so modified as to ameliorate conditions in our heaped-up cities and balance food production and food distribution against the industrial system.

Competence in this readjustment is not to be expected from such politicians as we have or are likely to have. Neither can it be expected that the voting public will elect competence, nor in the present state of things, at least, is competence likely to present itself for election, for it is a curious commentary on our so-called civilization that the most important business of the community is entrusted to those who have no knowledge or training in the art, while it is recognized in all other matters that competence, knowledge and training are necessary to produce results. Behind the elected man, however, there must be the trained administrator or executive with full power to carry out the general policies determined by the elected representative.

In any case, the engineer, who has produced the present industrialized system, will be called upon to carry out its modifications, for no other group can, and as such growth or changes to be permanent must be based upon the social trend of the community, the engineer's field will be greatly broadened, and his education extended through the necessary study of the social factors with which he must reckon if he is to function properly.

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*Delivered on Feb. 1st, at 4 P.M., at King Edward Hotel, Toronto.

The engineer in the past has been interested chiefly in the design and operation of mechanical equipment for the production of wealth, and in the construction of public necessities for community benefit, the whole initiated and determined upon generally by others to whom the benefits accrue, and has been regarded as an emergency man in other matters to be called in when things are desparate—to replace the old incompetents who soon return when matters become normal.

A Wider Field for the Engineer

Thus the signs of the time point to a wider conception of his function, covering a knowledge of human, social and business relations which in the past have not seemed to be within his purview.

To illustrate, the city manager is coming with, let us hope, no election pledges to keep, and no dependence upon the fickle and foolish decisions of the voter, but free to carry out as a real manager the necessary work of the community in the same way as the manager of a company.

Under this system, the German cities have provided such an object lesson that its adoption on this continent is progressing rapidly, and results are becoming apparent even to the general public.

This field belongs to the engineer more than to any other, and it only remains for him to occupy it and thereby to emerge from the shadow into the full view of the public, when his value may become apparent to all.

Company administration, especially where the basis is technical, is wide open, and, is being slowly occupied by the engineer.

Appointments on commissions of a technical nature, while rightly the engineer's due are but seldom realized, the political friends of the ruling classes being favoured to the detriment of the public service. This condition can be remedied only by incessant pressure of whatever kind most appeals to the politician, applied by powerful technical bodies.

The recent war emergency demonstrated the value of the engineer in fields other than those purely technical, but that lesson will fade out unless there is aggressive work carried on to perpetuate the system.

The standing of a man in the general community is not determined by his intrinsic worth, but by his visible or obvious power, whether expressed in money or in command. The engineer will never have the former, as he is no trader. Thus the only avenue to recognition and power is through services which cannot be realized otherwise than by means of his activities.

One man trained as an engineer, calling himself an engineer, and applying himself to such problems will be of more service to the profession as a whole in determining its status in the community, than ninety and nine who devote themselves to purely technical matters.

New Grouping in Engineering

Within their own particular technical field, too, the engineering groups are expanding and propagating new offspring. No longer are the civil, mechanical, electrical and mining specialties sufficient. The chemical engineer is with us, the physical engineer is on the way, and (with a little imagination assisted by the eye of faith) we dimly perceive indications of mental, moral and spiritual engineering, the first represented at present by the psychologist, and the other two nebulous fields beginning to be invaded by such men as Lodge, Crookes and Edison who are as yet, however, only crying in this weird wilderness.

Perhaps when it is realized that science is but ordered knowledge, and engineering but the application of science to practical uses, the above fantastic suggestions may not appear quite so absurd as at first glance.

Consider the entire spectrum of the scientific field of to-day from the dreaming transcendentalist at the violet end to the severely practical at the red end, and we find certain groups which may be classified as follows:—

1st—The pure dreamer, without practical sense, but useful sometimes for his inspiration to others.
2nd—The speculative researcher in pure science, actuated by love of his work only and without hope of pecuniary reward, who is really the spearhead of the scientific movement.
3rd—The industrial researcher, whose task consists in transforming the principles discovered in the purely scientific research field into practical form.
4th—The engineer proper, who applies commercially the work of the preceding groups to the uses of man.
5th—Industrialists, who for profit manufacture and market the brain products of the other groups.

We have here the whole scientific army ranged under the heads of practice, theory, hypothesis, speculation and dream, each forming, however, a link in that chain which supports and supplies the needs of humanity and each group reaping the reward for which it strives, whether in content of mind with work done at the one end of the spectrum, or in money and power at the other.

The members of this scientific industrial group, being mutually dependent, should and in fact must, develop a class consciousness, if they are to achieve the best results for the group and the community, in spite of apparent discrepancies in individual aim of the separate divisions.

Frankly, this is preaching a caste or guild system, a thing of evil to many. But why not? No profession ever emerged until it had become self-conscious and organized itself on a caste system, and no profession in the future ever will.

As a man thinketh, so is he, and as the members of the group have the same scientific reasoning processes, they must come together sooner or later and coalesce about some central nucleus.

Throughout the civilized world the engineers owing to their numbers, their organization, and their central position in the field of action, are the only practical nucleus around which the others may coalesce, and it is in this group that class consciousness is developing at last and rapidly. Is it not therefore incumbent on the engineering group that they organize and develop on such lines as will present attractions to the rest which cannot be ignored.

For years past, the engineers of the world have been developing powerful technical organizations covering specialties. The need of condensing on national lines has become apparent to such special groups. In consequence we find the Founder Societies in the United States coming together in the Federated Engineering Society while abroad in Europe the process is developing.

Fortunately we in Canada can congratulate ourselves that from the beginning we have had in *The Engineering Institute of Canada*, a nation-wide body embracing all classes of engineers, and able through its flexible organization to take in new specialties as they appear. In this fortunate situation we are years ahead of other engineering groups, even in the United States, where the idea is more advanced than elsewhere outside of this country.

That a powerful group as outlined above, covering scientists, engineers, and industrialists, would have an influence in the community in large matters goes without saying. Better still would be the action and interaction within the main body of the different groups to produce a well-rounded policy, applicable to all. Still better would be the effect on the individual members, who would have their horizons widened to include all science through intercourse with allied groups and individuals.

Within *The Engineering Institute* itself, the broadening influence of the mechanical, electrical, mining and other groups upon the original civils has been most apparent. The inclusion of others will be equally so on all, for the individual member, through access to papers, discussions and contact with those outside his particular specialty has inevitably benefited, and *The Institute* as a whole has a much wider outlook for this reason than the separate groups could have had if confined within the watertight compartments of their specialties.

Specialist Groups

To the possible objection that the specialist groups would lose their identity and no longer serve their purpose if included in a general society, it may be replied that sectioning for technical advantages is not only feasible but necessary; each sub-group remaining master of its own specialty, while retaining all the power which goes with combination.

Surely, the corrective and educational effect of bringing together (by way of illustration,) the pure scientists and the industrialists needs no argument. Neither knows the other nor ever will, unless by contact, both have their strength and weakness, and both need education on broad lines for their own as well as for the community's benefit.

There is little use in further labouring this point. Its obviousness is apparent, but the possibilities of practical attainment may be questioned. In reply, it may be assumed, that, given the obvious advantages of co-operation so plainly evident to minds accustomed to logical reasoning, the thing will inevitably accomplish itself some time and somewhere. The time is now and the where is here in our own *Institute*, for we are already leading the world along these lines and at this time have the tools, equipment and facilities to carry them out. There remains only the necessary will and activity which, if not within *The Institute*, will be found outside. In short we must expand broadly and wisely or relinquish our leadership in the scientific movement.

Leadership not Domination for the E.I.C.

On no question with which this body is concerned is there such need for a broad, generous policy, for inevitably the suggestion will be made that we are seeking to dominate, whereas the logic of the situation requires leadership and not domination, and that by the group best equipped for the task, which at the moment is evidently our own.

The frankest, freest co-operation should be maintained with bodies outside such as exists between this *Institute* and other Canadian societies, the American Founder Societies and others. Our facilities should be placed at their disposal whenever possible and in large matters they should be consulted freely, for only by such methods can we get that solidarity in the scientific group which the situation demands.

Associates and Affiliates

Among the outstanding industrialists, also, should be sought associates and affiliates to add to our membership especially in those industries whose basis is technical, whose problems are therefore largely technical and whose staffs consist largely of technical men.

The business knowledge and prestige of such associates cannot but help *The Institute*, and contact with these men will broaden the technician just as their contact with the scientist will have its educational effect upon the captains of industry.

If this class of associates and affiliates be extended wisely we can draw to our side those industrial leaders in the country who loom largest in the public view. At the other end of the spectrum we need the researchers who will some day rend the atom, lay bare its ultimate structure and provide such light that the chemical and physical engineers can follow and develop means for transforming atomic energy into commercial power after which those interested in the old prime movers will descend into the same limbo of disuse as the arrow maker of old. These men are coming and for them we engineers are merely the tool makers as in their trade they will use all the utensils which we have so far developed and unless we are in future to be a headless spear we must attach the spear head.

To the profession there are the academic gateways through which the graduate should march directly into the fold of *The Institute*, and the surest way to attain this result is to see that within college walls the advantages of Institute connection are presented both in and out of season.

This gospel should be preached by student missionaries within the student bodies themselves under direction of some committee charged with the task of seeing that few escape out of the fold into a cold world as mavericks without the Beaver brand.

Questions of Policy

In writing much of the above it is felt that a trespass is committed upon the field to be covered by the committee on Policy. In fact it is known that it will deal with some of these questions so that it can only be hoped that these remarks may not prejudice their case in advance for much is hoped from their report, which, when discussed and finally accepted, should give us definite lines along which to operate and for which adequate machinery must be provided, or their recommendations will be but the expression of more or less pious hopes.

When the Society was incorporated thirty-three years ago, its objects were set forth in the charter as follows:—

"Having for its object and purposes to facilitate the acquirement and interchange of professional knowledge among its members, and more particularly to promote the acquisition of that species of knowledge which has special reference to the profession of civil engineering, and further to encourage investigation in connection with all branches and departments of knowledge connected with the profession."

The existing by-laws of the vintage of 1918 specify the object of the Society as follows:—

"The object of this *Institute* shall be (a) To facilitate the acquirement and interchange of professional knowledge among the members. (b) To promote their professional interest. (c) To encourage original research. (d) to develop and maintain high standards in the engineering profession. (e) To enhance the usefulness of the profession to the public."

Clearly, therefore, the Society was established solely for the exchange of technical information, and equally clearly *The Institute's* present programme includes in addition the support of (b) The professional interests of its members. (c) The encouragement of research. (d) The ethics of the profession. (e) Usefulness to the public.

In view of past development and present trend, might we not add the following: (f) To educate the public to the value of the engineer. (g) To ensure that *The Institute* shall become and remain the central body in the field of science in this country.

Since the inauguration of the provincial Professional Engineers through whose activities legislation has been secured in most of the province in so short a time — the legal status of the engineer is in their keeping, and by so much are we relieved of a phase of former activities which might have seriously prejudiced attempts to bring in or affiliate with other groups. In short we are free at last to embark upon a wider policy and one dictated by the logic and history of the past and the requirements of the future.

Present day Tendencies

The days when the Nominating committee, the House and Library committee and the Papers committee supervised everything is past. The National committee on Standards has relieved us of that direct technical activity which occupied so much time of the members and the Council and its committees are now working on matters of broad policy while the production of papers and discussion of purely technical matters has become largely a routine matter for the Branches. This is not to say that the purely technical activities of *The Institute* have shrunk, as a matter of fact they have largely increased, but these through proper organization have been relegated to a secondary place in the work of the Council of *The Institute*, and that body is now left free to deal with the new problems of policy, organization and growth which are rightly those pertaining to the governing body of a large and growing organization. It has been suggested that the Council might be relieved of what is considered by some as the routine work of admission and classification of members, but it may be pointed out that this is routine work only in name, and that each list of candidates contains applications upon which the best consideration of the Council must be concentrated and decisions made on broad lines of well considered and consistent policy such as could not be given by local bodies with any certainty of securing uniformity in membership and promotion.

The old policy of concentration of power in the hands of a central body has yielded, (as it always must with growth) to a policy of devolution by which powers are delegated to local bodies, but is it a serious question as to how far this is advisable in the interest of *The Institute* as a whole.

The tendency of to-day is toward self-determination and the pendulum may swing far in the present atmosphere so that the danger of the future does not appear to lie in too much concentration of power, but towards, perhaps, too much devolution, and thereafter desintegration.

It is thoroughly realized that the activities of local bodies are of the utmost value, and lacking these that the Council of *The Institute* might become moribund, and the present active conditions cease to exist; but there is a limit to the swing of the pendulum beyond which a condition of unstable equilibrium will supervene and wreck the mechanism.

A wide delegation of powers has already been given and future action in the same direction should be taken with caution, for there are wide divergencies of interest in *The Institute*, both geographical and sectional, and while these are more apparent than real in view of the fact that the members are all technical men, yet hasty action on geographical, local or sectional lines is the most apparent menace at the present time.

In short, have we not arrived at the point where with a history and a tradition, a class consciousness, all the equipment of a great organization in working order, and an enthusiastic membership we are operating in a field which is ever widening and which we must occupy or disintegrate?

The Future

Our future is in our hands to-day, built upon the solid foundation of the past, for our growth has been slow and consistent, while our recent rapid increase of speed leaves us, at the moment, a little breathless, but still full of energy, which should not be expended in too rapid acceleration, for if ever there was a time in the history of *The Institute* when some solid thinking upon lines of broad policy should be undertaken, it is now — we have the foundation, the machine, the driving energy. Do we need further complication, or should we not be able to get production from what tools we have?

Our operating costs are high and match our revenues as they always should, for a society with an accumulated surplus is a society on the down grade. We can and should spend all our revenues in wise activities and have done so in the past. Our *Journal* has been built up out of revenues and our literary line of communication is, therefore, complete, but it remains to establish, as far as our finances will permit, personal relations throughout *The Institute* to the end that our membership will realize a solidarity which cannot be attained except through that personal contact which is so necessary if we are to keep our wide flung Empire together.

There is a practical side to this question which deserves serious attention for the activities of *The Institute* are so great that the financial burdens of the active members of Council and of various Committees are becoming serious. These men give their time and energy freely, and some means should be found to relieve them from the heavy burden of travelling expenses.

This matter must be handled very carefully and circumspectly so that *The Institute* may not overrun its revenues, but under some system of budgeting, it is hoped that a start may be made in the near future in a modest way without overrunning the definite amounts put aside in the budget for this justice to our active members.

If something of this kind is not done then the "get-together" programme of *The Institute* which is one of its most useful activities will not expand through sheer lack of financial ability on the part of our most valuable members to keep up with the demand for extended service.

Remuneration

The demands of the membership that something be done regarding material returns to the engineer commensurate with his value have been met by the appointment of a Remuneration Committee which has been at work for some time on this question, and their report is expected shortly. A fair and logical scale of remuneration will have a value of its own, apart from any active campaign for its application in all cases, for many employers of engineers, such as Municipalities and Governments, and also Arbitration Boards, will welcome a logical scale which they can use at least for purposes of comparison to guide them through the present swamp of confusion.

The membership, too, with their eyes on this scale will be able to push it forward as occasion presents itself, and gradually a general acceptance may be anticipated on the part of the public.

It must be remembered too that with a few acceptances of the proposed scale, especially on the part of municipalities, governments and large corporations, the rest will follow easily.

Relations with the U.S. Technical Societies

For some time past, a committee of the Council has been dealing with the matter of relations between *The Institute* and the Founder Societies of the United States, and later with the Engineering Council, and has met with the heartiest co-operation. These bodies have frankly and freely recognized that an engineer should belong, first, to his own national Society, and only thereafter consider outside bodies (thus confirming the long accepted doctrine of this *Institute*) and still further have themselves followed the same path through the establishment of the Federated Engineering Societies which is a national body.

Recently, a practical development of our cordial foreign relations has taken the form of an arrangement whereby any member of *The Institute* may obtain the publications of the American Society of Mechanical Engineers and the American Institute of Mining and Metallurgical Engineers at member's cost, and it is confidently expected that the other Founder Societies will follow. *The Institute* will, of course, reciprocate, so that the Engineering Fraternity, on both sides of the Line, will have at their disposal the Journals of the Technical Societies of both countries through membership in their respective national bodies.

Conclusion

In 1887 when this Society was organized civil engineering as distinguished from military engineering covered all. The mechanical engineer was being born, the electrical engineer was unknown and the mining engineer was really what is known as the civil engineer of to-day, applying himself more or less to mining constructions.

To-day all of these are represented by vigorous groups within *The Institute*. The birth of the chemical engineer is an accomplished thing. The physical engineer is expected, while still more nebulous groups are suspected.

Those who are about to be born salute you. Have we not a house prepared for them with accommodation for all?

The Institute of to-day is no narrow technical group but a widespread and powerful scientific body, capable of looking after the interests of its membership possessed of all the necessary organization and equipment energetically directed and ready to extend its hand in frank fellowship to kindred scientists.

Thirty-fifth Annual and General Professional Meeting

Registration

Montreal Meeting

No.	Name	No.	Name	No.	Name	No.	Name	No.	Name
1	R. A. Ross	15	Wm. D. Lawrence	28	H. L. Steenbuch	42	Louis G. Boisseau	55	E. T. Kirk
3	Arthur Vincent	16	C. G. J. Luck	29	B. L. Silver	43	Wm. T. Jamieson	56	R DeL French
4	Frank Peden	17	E. S. M. Lovelace	30	J. M. R. Fairbairn	44	M. A. Fullington	57	H. A. Terreault
5	C. H. Scheman	18	E. Béné	31	A. R. Patterson	45	A. P. Morrison	58	J. Henri Valiquette
6	James Ewing	19	A. Bertram	32	H. S. Deubelbel	46	F. W. Cooper	59	J. G Caron
7	L. G. Papineau	20	Edward L. Lyons	33	A. C. MacKenzie	47	R. M. Robertson	60	Narcisse J. A Vermette
8	E. Brown	21	J. H. McLaren	34	C. T. Delamere	48	I. Robertson	61	Frank V. Dowd
9	Frederick B. Brown	22	W. S. Lea	35	P. B. Motley	49	L. W. DesLauriers	62	F. Stuart Williamson
10	A. W. Swan	23	J. E. Beatty	36	G. R. MacLeod	50	C. S. Kane	63	Geo. K. McDougall
11	S. A. Neilson	24	E. Vinet	38	S. Fortin	51	Louis H. Laffoley	64	E. R. Pease
12	Fraser S. Keith	25	S. Svenningson	39	Ernest Fusey	52	W. J. McAllister	65	F. J. Hardman
13	Denis Farmer	26	John Morse	40	J. A. Bernier	53	Max A. Zuercher	67	Lesslie R Thomson
14	F. A. Combe	27	P. T. Kaelin	41	J. Emile Gill	54	E. G. E. Fiset	68	deGaspé Beaubien

Toronto Meeting

No.	Name	No.	Name	No.	Name	No.	Name	No.	Name
1	William Storrie	66	J. B. Carswell	131	H M. Shockley	196	A. W. Connor	261	H. A. Fair
2	William Gore	67	J. A. S. King	132	G. H. Harlow	197	J. B. Tyrrell	262	C. C. Wimperley
3	G. A. McCarthy	68	Willis MacLachlan	133	W. H Campbell	198	I. H. Levitt	263	C H. Keaslake
4	G. T. Clark	69	F. M. Brickenden	134	G. C. Briggs	199	W. E. Bennett	264	F. C. Rust
5	J. Mack	70	F. E. Sterns	135	O. V. Hall	200	L. E. Allen	265	C. H. S. Bell
6	W. T. Ashbridge	71	F. A. Dallyn	136	J. E. B. Shortt	201	A. E. Caddy	266	H. S. Weldon
7	Charles Robertson	72	K. H. Smith	137	M. C. Stafford	202	L. W. Wynne-Roberts	267	J. T. Magan
8	Allen Hazen	73	F. N. Speller	138	H. E. Purdy	203	R. B. Young	268	C. T. Thorlow
9	W. I. MacTavish	74	A. M. Jackson	139	C. R. Hayes	204	W. P. Merrick	269	H. H. MacLean
10	E. B. Allan	75	C. M. Goodrich	140	R. M. Hawkins	205	W. E. Stephens	270	R. R. Parker
11	A. P. Walker	76	C. M. Hookway	141	W. F. A. Bell	206	G. O. Parker	271	T. Clarke
12	R. H. Spence	77	J. L. Morris	142	A. R. Chadwall	207	F. P. Adams	272	W. C. Holland
13	L. E. Kendall	78	A. J. Lawrence	143	J. Beatty	208	W. G. Chace	273	M. B. Hastings
14	D. A. R. McCannell	79	J. H. Bradley	144	J. R. Tindlater	209	M. V. Sauer	274	L. H Hart
15	S. A. Lauzon	80	G. Phelps	145	J. Bedder	210	S. H. Johnston	275	Dr. R. E. Wodehouse
16	L. F. Merrylees	81	E. A. Wallberg	146	B. Goldstick	211	A. C. Oxley	276	W. A. Rotter
17	S. G. Smith	82	F. M. Byam	147	D. Brodie	212	C. B. Brown	277	Guy C. Dunn
18	A. A. Richardson	83	F. F. Clarke	148	James W. Moffatt	213	C. S. Gzowski	278	E. Stein
19	F. P. Fripp	84	N. L. Crosby	149	W. J. Baxter	214	R. A. Ross	280	G. G. Powell
20	A. N. Ball	85	F. Barber	150	R. H. Keefler	215	J. G. Jack	281	W. R. Rogers
21	H. T. Hazen	86	E. Hugll	151	F. W. Hamilton	216	A. M. Richardson	282	W. M. Treadgold
22	G. P. MacLaren	87	Thomas Taylor	152	J. R. Ammond	217	E. V. Johnson	283	R. W. Macintyre
23	J. C. Krumm	88	N. M. McLeod	153	S. Hardcastle	218	F. A. Robertson	284	T. H. Hogg
24	J. R Mackenzie	89	T. U. Fairlie	154	M. J. Butler	219	J. M. Mackintosh	285	B. N. Simpson
25	G. R. Heckle	90	C. G. Ericson	155	E. G. Hewson	220	B. Ripley	286	D. S. Kimball
26	V. E. A. Bélanger	91	E. D. Wilkes	156	J. M. Greig	221	J. H. Barber	287	H. A. Stevenson
27	E. M. Proctor	92	B. C. Berry	157	H. P. Heywood	222	V. R. Burge	288	F W. Fox
28	C. H. Rust	93	G. W. Rayner	158	U. R. Moore	223	S. P. Wilbert	289	A. MacPhail
29	L. W. Gill	94	J. R. Gilley	159	C. L. Hays	224	W. F. Scott	290	W. B. MacIntyre
30	H. C. Bates	95	F. J. Bell	160	C. T. Delamere	225	D. A. Ross	291	H. W. D. Armstrong
31	C. S. L. Hertzberg	96	J. H. Barber	161	A. C. Mackenzie	226	W. Barber	292	A. W. Smith
32	A. F. MacCallum	97	F. H. Moody	162	W. L. Saunders	227	W. Hickling	293	E. C. Warner
33	Willis Chipman	98	E. L. Miles	163	V. A. G. Dey	228	T. D. Lemay	294	W. H. Collins
34	R. B. Evans	99	W. Davis	164	S. Blumenthal	229	W. L. Dobbin	295	De Gaspé Beaubien
35	W. Cross	100	H. Kesteven-Balshaw	165	E. A. Dunn	230	D. S. Ellis	296	Dr. L. A. Herdt
36	W. W. Gunn	101	T. A. Ross	166	W. A. Bucke	231	W. E. Pummer	297	J. H. Learmonth
37	S. G. Tallman	102	E. Oliver	167	Jas. A. Vance	232	J. B. McAndrew	298	C. D. Roberts
38	R. O. Wynne-Roberts	103	R. W. Angus	168	N. E. Brooks	233	R. C. Maclachlan	299	R. B. Stewart
39	L. M. Jones	104	J. A. G. White	169	J. A. Bell	234	N. B. McLean	300	H. C. Basker
40	J. M. Gordon	105	G. A. McClintock	170	S. E. Bell	235	H. M. Morris	301	F. Moberly
41	J. M. Gibson	106	H. G. Hunter	171	H. B. R. Craig	236	H. G. Thompson	302	C. H. Mitchell
42	F. R. Wilfred	107	C. Stephen	172	D. M. Fraser	237	L. I. Stone	303	J. M. R. Fairbairn
43	T. S. Armstrong	108	G. H. Duggan	173	R. A. Baldwin	238	M. B. Watson	304	C. N. Mitchell
44	W. B. Proctor	109	A. S. Cook	174	A. H. Harkness	239	Julian C. Smith	305	J. Mackin
45	O. M. Falls	110	H. Robinson	175	T. D. Mylrea	240	P. C. Davidson	306	J. M. Oxley
46	C. A. Mullen	111	L. J. Murtha	176	J. R. Allison	241	A. G. Young	307	J. A. Maxwell
47	W. Huber	112	J. D. Walks	177	P. W. Gillen	242	S. L. Stuart	308	H. K. Dutcher
48	F. B. James	113	W. P. Dobson	178	E. Mattice	243	W. H. McAll	309	H. A. Goldman
49	H. J. Caldwell	114	P. A. Borden	179	W. B. Russel	244	J. R. McMurrich	310	W. R. Way
50	G. H. Bryson	115	George G. Cousins	180	H. J. Elliott	245	G. E. Booth	311	R. H. Harcourt
51	W. A McLean	116	Walter P. Chapman	181	C. H. MacLean	246	J. S. Wilson	312	D. O. Wing
52	F. R. Hamilton	117	H. L. Brown	182	A. P. Augustine	247	C. L. Heckey	313	F. C. Wight
53	R. W. Downie	118	A. J. Grant	183	W. B. Coulter	248	H. H. Couzens	314	Jas. Milne
54	F. B. Brown	119	H. J. Lidkea	184	L. F. Stokes	249	H. A. Rhodes	315	H. J. Ross
55	L. E. Westman	120	F. B. Coles	185	A. R. Davis	250	K. D. McDonald	316	E. T. J. Brandon
56	J. R. W. Ambrose	121	J. G. Spotton	186	H. J. Lamb	251	C. H. R. Fuller	317	A. A. Cole
57	A. R. Robertson	122	J. F. Phillips	187	R. G. Saunders	252	G. E. Stephenson	318	A. W. Reid
58	C. R. Young	123	B. F. Moffatr	188	N. Bowman	253	C. R. Murdock	319	J. J. Salmond
59	George E. Evans	124	H. R. McLymont	189	Gordon Grant	254	A. C. Tagge	320	L. L. Brown
60	W. J. Smither	125	G. H. Cross	190	C. E. Macdonald	255	T. M. West	321	Bruce Aldrich
61	M. Stewart	126	V. A. Medland	191	A. B. Ross	256	R. M. Mueller	322	S. W. Smart
62	C. A. Scott	127	M. D. Ross	192	J. Sinton	257	H. C. Crane	323	F. C. Dyer
63	C. H. Keefer	128	H. A. Bysshe	193	W. L. MacKenzie	258	D. T. Welsh	324	J. R. Cockburn
64	Fraser S. Keith	129	J. F. Young	194	E. H. Beck	259	F. L. Lawton	325	C. A. Norris
65	G. H. Power	130	H. S. Spencer	195	W. C. Miller	260	W. N. Smith	326	W. J. D. Reid-Lewis

No.	Name	No.	Name	No.	Name	No.	Name	No.	Name
327	C. P. Black	400	C. A. S. Wade	473	T. Murray Clark	546	John E. Henderson	620	F. J. Blair
328	J. R. Wainwright	401	S. E. McClelland	474	W. G. Milne	547	O. H. Coté	621	H. U. Hart
329	T. L. Crossley	402	H. N. Baker	475	S. F. Franky	548	D. O. Lewis	622	D. C. Tennant
330	W. H. Martin	403	R. H. B. Cook	476	B. H. Johnston	549	C. H. Scheman	623	K. P. Johnston
331	T. R. Loudon	404	W. A. Campbell	477	R. F. Ogilvy	550	W. Walker	624	E. G. R. Ardagh
332	H. E. T. Haultain	405	F. L. Wass	478	C. O. Vogen	551	A. A. Bélanger	625	J. F. Inderwick
333	A. N. Molesworth	406	M. V. Powell	479	T. S. Glover	552	G. M. Ponton	626	W. V. Taylor
334	E. T. Wilkie	407	E. F. Good	480	J. W. Bakman	553	G. B. Dodge	627	A. S. Going
335	A. G. Dalzell	408	G. E. McLean	481	W. J. Meriden	554	G. W. Burpee	628	F. L. C. Bond
336	F. W. Dunton	409	J. G. Inglis	482	H. L. Chappell	555	N. J. Ogilvie	629	F. W. Cowie
337	S. F. Emerson	410	A. R. Murphy	483	G. B. Fuller	556	G. Stead	630	H. B. Stuart
338	A. W. F. McQueen	411	R. J. McGraw	484	W. L. Miller	557	W. L. McFaul	631	D. T. Fraser
339	F. G. Engholm	412	J. K. Affleck	485	G. C. Mutch	558	E. R. Evans	632	W. A. M. Cook
340	G. Kydd	413	A. R. Duff	486	A. C. Loudon	559	C. P. Edwards	633	H. J. Franklin
341	J. M. Wilson	414	C. B. Joy	487	W. Harland	560	E. D. W. Courtice	634	P. T. Jackson
342	W. Armstrong	415	F. C. Monkman	488	G. C. Aykroyd	561	R. F. Uniacke	635	J. M. Campbell
343	F. F. Miller	416	T. M. Baird	489	J. H. Van Camp	562	J. B. Challies	636	A. Milne
344	H. J. Peckover	417	L. L. Campbell	490	A. S. Gray	563	J. T. Johnston	637	A. C. D. Blanchard
345	O. J. Grant	418	S. W. B. Black	491	W. D. Lappin	564	Norman Marr	638	A. Murray
346	D. Sheppard	419	A. B. Hubbard	492	W. A. White	565	A. M. Beale	639	L. Vardon
347	J. H. Johnson	420	J. A. Knight	493	R. Butler	566	A. R. Hannaford	640	R. C. Hardie
348	G. M. Thorpe	421	A. G. Lang	494	G. D Scott	567	R. Armour	641	R. K. Palmer
349	J. F. S. Madden	422	O. D. Johnston	495	A. H. Wessel	568	D. McPherson	642	C. H. Narrs
350	J. MacIntosh	423	H. C. Maedel	496	D. I. Natress	569	E. J. Furley	643	J. W. Turner
351	W. S. McDonald	424	R. J. McMillan	497	N. E. Elliott	570	R. B. Rogers	644	R. H. Tofflemire
352	C. B. Hamilton	425	W. L. Jack	498	A. J. M. Bowman	571	J. C. Keith	645	A. Hannan
353	R. A. McClellan	426	S. W. Henry	499	C. C. Ashcroft	572	W. H. Norrish	646	H. S. Pritchard
354	J. Murton	427	J. A. Pagett	500	W. F. B. Rubridge	573	J. E. Gibault	647	N. S. Grant
355	G. R. Jack	428	W. R. Bunting	501	A. T. C. McMaster	574	R. L. Dobbin	648	H. O. Kramer
356	A. L. Mudge	429	T. H. Take	502	J. H. Parkin	575	Allan Munro	649	A. L. S. Nash
357	A. E. K. Bunnell	430	A V. DeLaporte	503	W. A. Duff	576	E. P. Murphy	650	J. A. Langford
358	N. D. Wilson	431	F. E. Wilson	504	J. R. Bond	578	H. S. Van Scoyoc	651	Jas. McEvoy
359	F. B. Tapley	432	H. G. A. Chambers	505	H. M. Pardee	579	C. H. N. Connell	652	M. E. Dickenson
360	T. Ferrier	433	V. H. McIntyre	506	W. J. Shaw, Jr.	580	S. B. Wass	653	W. J. Armstrong
361	H. L. Seymour	434	H. H. Shotwell	507	J. H. Thompson	581	H. A. Lumsden	654	Paul Kircher
362	E. F. Armstrong	435	A. M. Anderson	508	W. B. Redman	582	S. C. Webb	655	F. McArthur
363	H. G. Hayman	436	G. F. Bryant	509	G. H. Mudge	583	A. B. Lambe	656	T. W. Jackson
364	J. W. G. Gibbs	437	B. H. Carnahan	510	G. O. Thorn	584	W. M. Scott	657	W. E. Douglas
365	S. C. Scadding	438	H. R. Powell	511	S. Ball	585	E. V. Moore	658	G. Gale
366	J. H. Curzon	439	V. Stewart	512	W. J. Parker	586	B. F. Haanel	659	Gord. Mitchell
367	J. C. Elder	440	L. Summers	513	J. G. Johnston	587	R. J. Durley	660	L. F. Barnes
368	P. B. Motley	441	H. L. Graham	514	G. G. Macdonald	588	J. W. Harkom	661	H. B. Norwich
369	P. P. Westbye	442	C. Hamilton	515	R. Harrison	589	H. T. Kirkpatrick	662	P. L. Latham
370	A. P. Black	443	R. W. Kendershot	516	G. A. H. Burn	590	F. M. Waddell	663	H. B. Dwight
371	R. W. Beckett	444	W. P. McDonell	517	E. W. Johnston	591	E. P. Murphy	664	A. E. Davison
372	E. R. Martyn	445	W. R. Cowan	518	W. D. Walcott	592	H. M. Davy	665	E. M. Faris
373	J. MacLaren	446	W. S. Wilson	519	C. T. Smith	593	J. S. Mitchell	666	J. M. Fraser
374	H. P. Thomson	447	B. E. Norrish	520	R. H. Switzer	594	W. G. Matheson	667	R. S. C. Bothwell
375	Peter Gillespie	448	W. Dickson	521	A. D. Sword	595	F. C. Jewett	668	A. C. Grant
376	C. E. Sisson	449	E. C. Goldie	522	C. H. Fullerton	596	T. L. Hughson	669	R. V. Pleines
377	J. W. Orrock	450	J. E. Beatty	523	A. Hadley	597	G. F. Vollmer	670	F. W. Simpson
378	J. E. Porter	451	R. H. Parsons	524	F. A. Murphy	598	C. D. Collins	671	H. D. Lumsden
379	H. C. Boyden	452	Geo. C. MacKenzie	525	E. R. Grange	599	R. C Purser	672	T. A. Haw
380	R. C. Flitton	453	R. E. W. Hagarty	526	A. E. Berry	600	A. S. Miller	673	S. H. Peppler
381	H. C. Morley	454	J. G. Dennis	527	W. C. Cooper	601	Alex Potter	674	W. H Breithaupt
382	J. W. Bain	455	H. B. Fenton	528	J. E. B. Shortt	602	W. H. Magwood	675	D. A. Williamson
383	E. H. Darling	456	H. A. Moore	529	M. C. Stafford	603	W. M. Miller	676	R. Dill
384	A. Gray	457	W. J. Forbes-Mitchell	530	L. T. McNaughton	604	Robt. Bugdie	677	W. A. Crane
385	W. H. Nixon	458	C. N. Ridout	531	C. C. Cariss	605	F. M. Duckett	678	W. H. Riehl
386	C. B. Lailly	459	F. S. Rutherford	532	T. K. McNamara	606	H. S. Philips	679	J. M. Smith
387	P. S. Dunbar	460	W. B. Redfern	533	T. M. McCowan	607	F. J. Hancox	680	R. Moffat
388	W. Bardsley	461	Herbert Horsfall	534	C. H. R. Fuller	608	L. T. Acton	681	B. E. Schimburn
389	S. L. Galbraith	462	O. V. T. Sanderson	535	F. S. Lazier	609	J. R. Donaldy	682	J. R. Dunbar
390	H. H. Mueller	463	A. A. Bowman	536	N. R. Gibson	610	A. R. Henry	683	J. C. Highbee
391	W. R. Benson	464	A. McDougall	537	F. A. Gaby	611	R. M Carmichael	684	A. T. Laing
392	J. J. Crawford	465	C. B. Ferris	538	M. Pequegnat	612	Francis Herbert	685	C. R. Scott
393	S. Smillie	466	H. E. Dewey	539	S. L. Grenzebach	613	O. Rolfson	686	J. R. McLean
394	A M. Patience	467	O. Holden	540	H. Stark	614	M. F. Cochrane	687	B. W. Paget
395	S. Shields	468	H G. McVean	541	R. Morham	615	F. W. Thorold	688	E. N. Ridley
396	W. J. W. Reid	469	G. G. Ammaney	542	R. Rossiter	616	T. V. McCarthy	689	H. L. Bucke
397	C. B. Ferris	470	W. L. Malcolm	543	J. R. Dunbar	617	J. J. Ramsay		
398	K. Greig	471	W. P. Wilgar	544	C. W. Stokes	618	W. H. Bonus		
399	A. C. Sanderson	472	G. H. Crase	545	H. Luscombe	619	Geo. W. Watts		

Ladies

No.	Name	No.	Name	No.	Name	No.	Name	No.	Name
691	Mrs. F. F. Miller	711	Mrs. J. G. Jack	731	Miss My. Hamilton	751	Mrs. McMillan	770	Mrs. G. Hogarth
692	Mrs. W. M. Miller	712	Mrs. Geo. Clark	732	Mrs. R. W. Angus	752	Mrs. J. R. Bond	771	Mrs. Wm. Bucke
693	Mrs. T. D Mylrea	713	Mrs. Wm. Storrie	733	Mrs. Alex Greenless	753	Mrs. James McEvoy	772	Mrs. C. S. L. Hertzberg
694	Mrs. J. M. R. Fairbairn	714	Mrs. W. L. McFaul	734	Mrs. Walcott	754	Miss S. M. Lambe	773	Mrs. H Horsfall
695	Mrs. F. Serrurier	715	Mrs. W. H. Collins	735	Mrs. C. E. Sisson	755	Mrs. Donald Potter	774	Mrs. E. T. J. Brandon
696	Mrs. S. G. Talman	716	Mrs. A. B. Collins	736	Mrs. E. G. Hewson	756	Mrs. Alexander Potter	775	Mrs. B. C. Berry
697	Mrs. L. E. Allen	717	Mrs. E. S. Mattice	737	Mrs. W. J. Mactavish	757	Mrs. H. L. Bucke	776	Mrs. F. A. Dallyn
698	Mrs. G. H. Bryson	718	Mrs. Gordon Jack	738	Mrs. W. P. Merrick	758	Mrs. H. L. Seymour	777	Mrs. P. Gillespie
699	Miss Moffat	719	Mrs. H. B. R. Craig	739	Mrs. W. E. Brown	759	Mrs. T. R. Loudon	778	Miss Hamilton
700	Mrs. R. H. Harcourt	720	Mrs. J. C. Keith	740	Mrs. J. C. Krumm	760	Mrs. G. A. McCarthy	779	Mrs. H. E. T. Haultain
701	Mrs. H. K. Dutcher	721	Mrs. J. B. Challies	741	Miss A. Marcusson	761	Mrs C. H. Mitchell	780	Mrs. H. J. Lamb
702	Mrs. F. G. Engholm	722	Mrs. J. R. Malcolm	742	Mrs. G. H. Power	762	Mrs. Frank Barber	781	Mrs. C. H. Mitchell
703	Mrs. A. A. Richardson	723	Mrs. E. M. Proctor	743	Mrs. F. B. James	763	Mrs. Melville White	782	Mrs. Geo. Phelps
704	Mrs. J. E. Gibault	724	Mrs. A. R. Robertson	744	Mrs. W. Huber	764	Mrs. R. A. Ross	783	Mrs. I. H. Nevitt
705	Mrs. V. Bélanger	725	Mrs. F. B. Brown	745	Mrs. H. A. Goldman	765	Mrs. R. O. Wynne-Roberts	784	Mrs. Warren Smith
706	Mrs. N. E. Brooks	726	Mrs. T. L. Crossley	746	Mrs. E. Preston Johnson			785	Mrs. A. C. D. Blanchard
707	Mrs. James A. Bell	727	Mrs. Fraser S. Keith	747	Mrs. H. A. Gemmell	766	Miss Wynne-Roberts	786	Mrs. F. McCarthy
708	Mrs. F. P. Adams	728	Mrs. Alex J. Grant	748	Mrs. F. W. Thorold	767	Mrs. C. H. Rust	787	Mrs. Adams
709	Mrs. G. R. Jack	729	Mrs. W. G. Chace	749	Mrs. C. R. Young	768	Mrs. F. A. Gaby	788	Mrs. Oxley
710	Mrs. A. Luff	730	Mrs. M. B. Watson	750	Mrs. R. G. Saunders	769	Mrs. J. R. W. Ambrose		

CORRESPONDENCE

Classes of Membership in the Engineering Institute

February 7th, 1921.

Editor, *Journal:* –
Dear Sir;—

From the discussion concerning the classes of membership in *The Engineering Institute* which took place at the Annual Meeting at the Toronto Convention last week, I came to the conclusion that the following arrangement of membership would be the best:

Senior of *The Engineering Institute of Canada*, with vote
Member " " " " "
Junior " " " " without vote
Associate " " " " "

Senior:—It seems to me that the word Senior, implying both membership and standing, age and experience, is better than such a word as Fellow, which some think implies rather a caste in *The Institute.* The class of Seniors should about correspond to the class now designated as Members.

Member:—The words Associate Member have never seemed to me appropriate; for the men now designated by that title are really the main body or qualified membership of *The Institute.* Why not just drop the word Associate from the title of this class.

Junior:—It seems to me that there need be no distinction between the Student and the Junior, and that the Student might well be at once placed in the Junior Class. This class should remain a continuing one, to a fairly high age limit, thus removing the loss of membership by lapse of time.

Associate:—The word Associate applied to our friends in industry who are often with us but are not engineers, seems to exactly describe the relationship that we wish to create. It means something definite when so used, which is more than I can find it does when prefixed to the word Member.

Control:—Would it not be well to work out some scheme whereby Juniors and Associates, who form the non-corporate membership, would have a limited right to vote on matters of general interest to all; while only the corporate membership, the Seniors and Members, would have the right to vote on corporate and purely technical matters, coupled with the right to veto, by say a two-thirds majority, the vote of the non-corporate members. This last is but a hazy suggestion which has not yet taken very definite form in my mind; possibly some brother engineer can develop it further.

Sincerely yours,
CHARLES A. MULLEN, M.E.I.C.
Milton Hersey Co. Ltd.
Industrial Chemists, Engineers and Inspectors
84 St. Antoine Street,
Montreal.

What is an Engineer?

Editor, *Journal:* –
Dear Sir:—

To illustrate the popular idea, the following quite authentic anecdote will serve:

A gentleman wishing to speak over the telephone to a member of the staff of the Public Works Engineer, asked the operator at the exchange of a certain Parliament Buildings for the Engineers Department.

The operator switched him through to the *Boiler Room.*

It seemed to me to be too good a story to let slip, and yet it has a moral as well. The public has to be educated.

Yours truly,
H. M. BIGWOOD, A.M.E.I.C.
Victoria, B.C.

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Invitation to Meeting of Canadian Institute of Mining and Metallurgy

January 27th, 1921.

Editor, *Journal:*—
Dear Sir:—

On behalf of my Council I have the honour to extend to the executive officers and members of *The Engineering Institute of Canada* a cordial invitation to attend the forthcoming meeting of the Canadian Institute of Mining and Metallurgy at the Windsor Hotel, Montreal, on the second to the fourth of March, inclusive.

Yours faithfully,
(Signed) GEO. C. MACKENZIE,
Secretary-Treasurer.
The Canadian Institute of Mining
and Metallurgy,
503-504 Drummond Building,
Montreal.

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Town Planning News and Comments

H. L. Seymour, A.M.E.I.C.

It is a matter of belief with the town planner that the city engineer of the future, whatever may be his other qualifications, will be a town planner. In this connection of interest to Canadian city engineers is the following British news.

H. M. Stilgoe, M.I.C.E., superintendent of the Metropolitan Water Board of London was elected to the position of President of the Town Planning Institute of Great Britain; John Brodie, city engineer of Liverpool and member of the British Town Planning Institute was elected to the position of President of the Institution of Civil Engineers.

Both Mr. Stilgoe and Mr. Brodie have made their reputations as city engineers who have early associated themselves with town planning. They have been responsible for important town planning developments in large cities of England.

Mr. Stilgoe in his recent presidential address to the Town Planning Institute of Great Britain dealt with the importance of the planning of arterial roads in the vicinity of cities and the regional treatment of the problem of town planning.

Mr. Brodie, it may be mentioned, was elected Professor of Engineering of the Liverpool University in 1903 and has since had the degree of Master of Engineering conferred upon him by the same university. In 1912 he was appointed on a committee of experts to advise the government on the layout of Delhi as the capital of India.

Ontario Town Planning and Housing Conference

There was held in Toronto, beginning the 17th of February, a two days Town Planning and Housing Conference. The following list includes some of the engineers taking a prominent part in the programme.

Noulan Cauchon, A.M.E.I.C., "Economics of Town Planning".

J. P. Hynes, A.M.E.I.C., "Where Responsibility for Town Planning Rests".

E. L. Cousins, A.M.E.I.C., Planning for Greater Toronto, — "Harbour Developments".

Frank Barber, A.M.E.I.C., Planning for Greater Toronto, — "Regional Planning".

W. H. Breithaupt, M.E.I.C., Chairman of the Kitchener Town Planning Commission.

Included on the Conference Committee are Messrs. J. P. Hynes, A.M.E.I.C., Chairman; W. H. Breithaupt, M.E.I.C.; E. L. Cousins, A.M.E.I.C.; H. L. Seymour, A.M.E.I.C., and N. D. Wilson, A.M.E.I.C.

Town Planning in Saskatchewan

A criticism that is frequently made, and a criticism, for which it must be admitted there is considerable justification, is that a great deal has been said about Town Planning in Canada but unfortunately little actual work has been accomplished; that while considerable legislation has been enacted but little advantage has been taken of it. There are many reasons that might be advanced to account for such conditions. While seven of the Provinces of Canada have legislation most of these provinces have provided no machinery by which the provision of such legislation can be carried out. This cannot be said of the Province of Saskatchewan, where there is in existence a definite Town Planning and Rural development Branch of the Department of Municipal affairs.

M. B. Weekes, M.E.I.C., is the director of town planning. Under his direction and with the valuable assistance of W. A. Begg, A.M.E.I.C., town planning engineer, the necessary regulations and by-laws have been prepared to make Town Planning effective under the Saskatchewan Act. In Mr. Weekes' last yearly report he gives some idea of the work that must have been undertaken by his Department in this connection, and also a list of the Development Plans that have already been approved. The last publication from his Department is entitled "Model Form of Development By-Law". This is a By-law adopted for an urban area of 5,000 population and over. It is an excellent guide to municipalities in preparing Town Planning by-laws or Provisions. It deals with the questions of new streets and sub-divisions, main thoroughfares and width of streets and roads, building lines, zoning provisions for the establishment of Use, Height and Area Districts, of public reserves and open spaces. The Province of Saskatchewan is undoubtedly to be congratulated on the manner in which her Town Planning Legislation is being carried out under the capable direction of members of *The Engineering Institute of Canada.*

General Notes

The serious manner in which Town Planning is being regarded in numerous cities in the United States can be gathered from the example of St. Paul, Minnesota. The City Council has appropriated for work in 1921, $23,000 for general Town Planning work and a balance of $10,500 in the last year's funds has been re-appropriated, $8,800 for a zoning survey and $2,000 for a survey of street railway facilities and a report on re-routing.

In the January 1920 issue of *The Journal* of *The Engineering Institute of Canada* it was mentioned that in France, which affords such a splendid example in planning as Paris, Town Planning since 1919 has been compulsory. Mr. Ford, a New York City Planner who has spent the last five years in France, estimates that in the devasted regions there are at least 2,600 towns and villages for which new town plans are being made.

*

Henry Saxon Snell Prize

A competition for the Henry Saxon Snell Prize is announced by The Royal Sanitary Institute, 90, Buckingham Palace Road, London, S.W.I. The Prize in 1921 will consist of Fifty Guineas and the Medal of the Institute, and is offered for an Essay on "Suggestions for a System of Central Hot Water Supply and Heating, adapted to Modern Housing Schemes, and to existing groups of Houses".

The following points should be dealt with:

1. Central installation.
2. Appliances for and methods of distribution.
3. Methods of conserving the heat.
4. Provision for continued supply during repair of system.
5. Cost; initial and service.
6. Combination with other services for reducing expenses.

The Essay should consist of not more than five thousand words, and must be delivered on or before August 31st, 1921.

The following points must be observed:—

The Essay is to be submitted without the name of the competitor, and will bear a motto, legibly marked on the right hand lower angle of the first sheet.

The Essay is to be enclosed in an envelope, bearing the words "Henry Saxon Snell Prize", and the competitor's motto at the right hand lower angle.

The Essay will be accompanied by a letter containing the competitor's name and address, enclosed in a separate envelope, sealed with a blank seal, and having on the outside "The Henry Saxon Snell Prize", and the same motto as that attached to the Essay.

EMPLOYMENT BUREAU

To make this department more valuable it is proposed that in future advertisements of situations vacant should state salary, and give details of requirements.

Situations Vacant

Construction Engineer

An experienced civil engineer wanted to take complete charge of construction work for large pulp and paper project. Executive experience on similar work absolutely essential. Salary $400.00 per month up. Box No. 192.

Structural Steel Designer

Wanted—Structural steel designer as chief engineer for a growing fabricating company having an annual capacity of 8,000 tons per year. Applicant must have a technical education and have had at least ten years' actual detailing and designing experience with some bridge company. All replies strictly confidential. Apply, giving age, experience and salary expected, to Box 194.

Situations Wanted

Civil Engineer

Civil Engineer, graduate, Jr.E.I.C., age 26. Open for immediate engagement. Ten years' field and office experience in railway, municipal and highway engineering, including three years as engineer officer overseas. Good references. Desire permanent position. Prefer construction work. Box 55-P.

Civil Engineer

Civil Engineer, 38, with fourteen years' experience as draughtsman, instrumentman and engineer in charge. Thorough training in building and bridge construction, foundation work, also in quantity surveying and appraisal work, desires position as construction engineer with corporation or as superintendent with contractors. Open for engagement at once. Full particulars of experience and reference furnished. Box 56-P.

List of Student Members E.I.C. at University of Toronto, Desiring Summer Employment.

Name	Returned Soldier	Home address	Work desired	Number Months Experience
4th Year				
Herold, W. H.			Industrial work	5 Mos. Locomotive shop.
Relyea, J. D.			Industrial work	Mill machinery installation.
Shortt, J E. B.				Assembly and shop experience.
Keenleyside, R. D.			Manufacturing	3 years assembly work etc.
McNaughton, L. T.			Industrial	11 years in metal working as mach.
Spencer, H. S			Commercial work	Sales and shop.
Dunton, F. W.			Industrial or commercial	Shop and construction.
Mounder, W. F.			Commercial	Shop, construction and commercial.
Stafford, M. C.			Industrial	Shop, drafting and office.
3rd Year Civil				
Anderson, A. M.	R.S.	S.P.S.	Const. or hydraulic survey	
Hayman, H. G		6 Millbrooke Cres., Toronto	C. E. work, Toronto	4 mos.
Ashcroft, C. C.	R.S.	York Mills, Ont	Steel or concrete const.	4 mos. steel shop.
Pollock, F. J	R.S.	Almonte, Ont	Town engineering	Summer Survey Militia.
Zealand, E. L		250 Herkimer St., Hamilton	General	3 mos. Rail. survey.
McLintock, G. A.	R.S.	4 Dundonald St., Toronto	Const. or hydraulic	4 years.
James W. S. Gibbs		263 Spadina Ave., Toronto	Civil	
Electrical				
Montemunro, W.		Box 25, North Bay, Ont	Shop work (winding)	
Leldon, H. S	R.S.	Oakwood, Ont	Outdoor or testing	
Bryant, G. F	R.S.	Box 592 Midland, Ont	Outdoor or repair	9 mos.
Langford, J. A.		304 Superor Ave., Calgary	Outdoor or repair	
Simcoe, C. Scadding		Engineer'g Bldg. U. of T.,Toronto	Electric railway	5 mos. surveying, 5 mos. railway.
David Burns		Central Y.M.C.A., Toronto	Power station	
John G. Spotton		Engineer'g Bldg. U. of T., Toronto	Hydro-electric	20 mos. electrical and mechanical.

List of Student Members E.I.C. at University of Toronto, Desiring Summer Employment

Name	Returned Soldier	Home address	Work desired	Number months Experience
Chemical				
Jackson, Crawford		85 Blour St. E., Toronto	Chem. plant	6 mos. shop experience.
Campbell, W. A.	R.S.	247 Quebec Ave., Toronto	Chem. or eng. plant	
Grant, L. G.		83 Quebec Ave., Toronto	Production dept., chem. or const. plant	12 mos.
Carslake, C. H.	R.S.	10 Smith St., Toronto	Industrial or eng. work	
Moor, H. H.		63 Granby Ave., Toronto	Indust. or electro chem.	
Wass, J. L.		St. Mary, Ont.	Indust. chem. work	3 mos.
Winter, L. A. G.		134 Stibbard, Toronto	Indust. chem. work	8 mos.
Schemnitz, D. A.		765 Shaw St.	Metallurgical work	12 mos.
Richardson, W. R.		Essex, Ont.	Metallurgical work	6 mos.
Kay, J. A.		174 Church St., Stratford	Chem. lab	12 mos.
Westren		12 Lynwood Ave., Toronto	Indust. chem. work	3 mos.
Day, G. A.		S.P.S. (Guelph, Ont.)	And's. heavy chem.	
Reynolds, H.		43 Lockwood Rd., Toronto	Textile or Swiss embroidery	6 mos.
Chantler, W.	R.S.	10 Summerville, Mt. Denis, Ont.	Chem. plant (outdoor)	
Wynne-Roberts, R. I.		20 Selby St., Toronto	Paper or textile dye	12 mos.
Spence, F. S.		27 Linden St., Toronto	Chem. plant install'n.	
2nd Year Civil				
Ball, Frank C.		168 Adelaide St., London, Ont.		
Bennet, Willard E.	R.S.	143 Bloor St. West, Toronto, Ont.	Building construction	3 mos. building const., 10 mos. D.L.S. Survey.
Beecroft, G. W.	R.S.	49 Gilmoor Ave., Toronto	Surveying	
Byram, A. T.		312 Quebec Ave., Toronto	Survey, highway or railway eng.	
Carp, M.		140 Brunswick Ave., Toronto	Survey or construction	
Carruthers, Y. H. H.	R.S.	40 Willcocks St., Toronto, Ont	Railway or highway constr'n.	2 yrs. C.G. railway survey, 2 summers C.P.R. survey.
Earle, Morrison D.		138 St. George St., Toronto	Construction	
Erwin, Robt. B.		126 Cumberland St., Toronto	Railway or highway eng.	
Hawkins, W. J. H.	R.S.	Islington, Ont.	Survey or construction	5½ mos. Surveying.
Highbee, J. C.	R.S.	180 Huron St., Toronto	Topographical survey	8 mos. as Inst'man.
Hitchon, Lawrence E.		7 Roberts Ave., Brantford, Ont.	Construction	5 mos. Inspector of concrete, highway const.
Jackson, C. H.		20 Sussex Ave., Toronto	Survey, construction or dratfing	Had experience in Surveying, concrete and Highway Const.
Joy, Clyde B.	R.S.	124 High Park Ave., Toronto	Bridge or building const.	5 mos. Surveying (Subdivisions).
Keith, W. H.	R.S.	Newmarket, Ont.	Survey, construction or drafting	Concrete work, water works highway and Surveying.
Kenny, W. E.		544 Church St., Toronto	Survey or construction	
Leslie, Roy C.		304 Windermere Ave., Swansea, Toronto.	Survey or construction	
Lewis, C. E.		357 Markham St., Toronto	Survey or construction	
McIntyre, Y. H.		408 Palmerston Ave., Toronto	Bridge and construction	
McKay, Hugh A.		119 Essex Ave., Toronto	Bridge or building construction	3 mos. bldg. construction.
Murtha, Leo	R.S.	283 Berkley St., Toronto	Survey or with town or city eng.	
Nettleton, C. A.	R.S.	15 Ross St., Toronto	Survey or construction	5 mos. "Roadways Lection", Dept. of Works, Toronto.
Norris, C. A.	R.S.	36 St. Clair Ave. East, Toronto	Construction	3 summers, house and factory Construction.
Siddall, K. C.		Islington, Ont.	Steel or concrete work	
Smith, J. M.	R.S.	Durham, Ont.	Survey or oncstruction.	
Stokes, La Yerne F.	R.S.	18 Wilcox St., Toronto	Railway or constr'n or bridge	
Welsh, D. T.		395MacNabNorth,Hamilton,Ont.	Bridge or building const.	
Mining				
Lyle, F. J.	R.S.	Brantford, Ont.	Mining	5 mos.
Morrison, R. G.	R.S.	931 Tegler Bldg., Edmonton	Construction	5 mos.
Tomlinson, F. C.	R.S.	Langstaff	Mining	5 mos.
Faircombe, H. F.	R.S.	Trenton, Ont.	Mining	3 mos.
Anderson, W. S.		Oil Springs, Ont.	Mining	5 mos.
Cockshutt, C. F.		Brantford, Ont.	Mining	5 mos.
Bull, W. J.		Weston, Ont.	Mining	5 mos.
Dumbrille, J. C.		Kemptville, Ont.	Mining	5 mos.
Lyle, V. B.	R.S.	Peterboro, Ont.	Mining	5 mos.
Nethercott, F. A.	R.S.	Stratford, Ont.	Mining	3 mos.
Dunbar, W. R.	R.S.	Ethel, Ont.	Mining	4 mos.
Gray, K. C.	R.S.	Coldwater, Ont.	Mining	5 mos.
Boyd, O. H.		40 Radford Ave., Toronto	Mining	5 mos.
Bowyer, C. M.	R.S.	Simcoe, Ont.	Mining	5 mos.
Dunlop, G. P.	R.S.	Box 313, Pembroke, Ont.	Mining	5 mos.
Leo. Murtha		283 Berkeley St., Toronto	Municipal or construction	

List of Student Members E.I.C. at University of Toronto, Desiring Summer Employment

Name	Returned Soldier	Home address	Work desired	Number months Experience
Mechanical				
Carley, F. C.	R.S.	2575 Dundas St., Toronto	Moulding or pattern making	
Beger, R. R.		New Hamburg	Machine shop	4 mos.
Crowe, G. F.	R.S.	R.R. No. 5, Truro, N.S.	Mach. shop draughting	3½ yrs. shop, 9 mos. office.
Dyer, J. W.	R.S.	Goderich, Ont.	Machinist	6 mos.
Johnston, J. G.	R.S.	83 Cowan Ave., Toronto	Machine shop	
Kennedy, W. W.		423 Grace St., Toronto	Construction	
McQueen, A. W.	R.S.	Nottawa, Simcoe Co., Ont.	Mech. or elect.	
Bell, Wm. Thos. A.		Engineer'g Bldg. U. of T., Toronto	Mechanical	5 mos. installing water power machinery.
Electrical				
MacLellan, J.		Claremont. Ont.	Electrical	
Meikle, W.	R.S.	Midland, Ont	Electrical	
Lawton, F. L.		S.P.S.	Electrical	
Gray, A. S.		191 Osler Ave., Toronto	Elect. mach. shop	
Stewart, L. D.		5 Edgedale Rd., Toronto	Elect. mach. shop.	
Martyn, E. R.		Ripley	Electrical	
Beckett, R. W.	R.S.	74 Carling Ave., Ottawa	Elect. or Mech.	4 mos.
Cain, L. A.		84 Grace St., Toronto	Electrical	
Rundle. W. L.	R.S.	Dundalk, Ont	Electrical	6 mos.
Vernon, A.		72 Harland Ave., Toronto	Elect. or Mech.	
Fardoe, H. R.		61 Greenville St., Toronto	Electrical	21 mos.
Guenther, W. F.		98 William St., Brantford	Electrical	
Kent, W. H.		84 Grant Ave., Hamilton	Electrical	
Inglis, J. C.		Atwood, Ont.	Electrical	
Ellis, F. G.		81 Concord Ave., Toronto	Elect. or Mech.	5 mos. shop.
Elliott, F. W.		958 St. Clarens Ave., Toronto	Electrical	4 mos. stationary engineer.
Hawkins, Ralph M.		Engineer'g Bldg. U. of T., Toronto	Electrical	5 mos. electricians helper.
Chemical				
Kestevan-Balshaw, H.	R.S.	208 Kingswood Rd., Toronto	Oils, wood, coal.	18 mos. Dom. Tar. & Chem. Co.
Johnston, O. D.	R.S.	East residence, Toronto Univ.	Industrial chem	5 mos. pulp coy.
Carnahan, E.		Campbellford, Ont.	Survey, party	
Hamilton, K. C.	R.S.	North residence, Toronto Univ.	Chem. or metallurgical	5 mos. brass wks.
McMillan, R. I.	R.S.	16 Maitland St., Toronto	Pulp or chem. wks.	
Hewgill, R.		526 Palmerston Blvd, Toronto	Industrial chem.	
Duffill, M. F.		537 Palmerston Blvd., Toronto	Industrial chem.	
Turner, J. W.		110 Yorkville Ave., Toronto	Industrial chem.	
1st Year General:—				
Barley, E. B.		245 High Park Ave., Toronto	Elect. mfg. coy.	6 mos.
Beaman, E. A.		North Gower, Ont.	Elect. or survey	
Cowan, W. R.		216 Cottingham St., Toronto	Roads or waterworks	4 yrs.
Good, E. F.		Blair, Ont.	Elect. or survey	
McDowell, W. O.		63 Ravnia Cres., Toronto	Elect. or shop	
Moon, A. M.		Wiarton, Ont.	Elect. mfg. coy.	12 mos.
Pedder, J. F.		Trout Creek, Ont.	Elect. mfg. coy.	
Reid, W. I. W.	R.S.	1010 Ossington Ave., Toronto	Elect. const. or oper.	Gas engines.
Simpson, W. L.	R.S.	Elmvale, Ont.	Elect. const. or oper.	
Rowat, G. H.		3 Spring St. Moore Pk., Toronto	Machine shop	2 yrs. assist. foreman.
Clarke, H. S.		81 Acme St., Toronto	Electrical work	
Elliot, W. K.		98 Metcalfe St. St. Thomas, Ont.	Shop work	4 mos.
Patience, A. M.		27 Wroxeter Ave. Toronto	Electrical work	
Smart, G. W.	R.S.	71 Harland Ave., Toronto	Elect. work	wireless in army.
Adams, H. C.		8 Henry St., Lindsay, Ont.	Concrete or survey	
Davis, C. R.		196 East Main St., Welland, Ont,.	Machine shop	24 mos. shop.
Hardcastle, S.		159 Glenmore Rd., Toronto	Const. or survey	3 mos. survey.
Ings, J. H.		52 Albany Ave., Toronto	Steel const.	4 mos. survey.
Keefler, R. H.		18 Pinewood Ave., Toronto	Machine shop.	
Sharpe, C. T.	R.S.	75 Jameson Ave., Toronto	Ry. survey	

PERSONALS

Léon L. Bourque, Jr.E.I.C., is now with the Road Department, City of Montreal.

*

J. Comeau, S.E.I.C., has accepted a position with the Quebec-Chibougamon Railway, with headquarters at Chicoutimi.

*

C. H. N. Connell, A.M.E.I.C., has been appointed district engineer over Ontario Lines of the Canadian National Railways.

*

Joseph W. Hayward, A.M.E.I.C., is now with the engineering department, College of the City of New York and expects to be in New York until June next.

*

K. O. Elderkin, Jr.E.I.C., has accepted a position with D. G. Loomis and Son, general contractors on the St. Margarets Bay power development, as foreman on the erection of hydraulic units.

*

W. A. Bowden, M.E.I.C., chief engineer of the Department of Railways and Canals, is paying a visit to the Panama Canal with a view to examining the operation of the Canal and canal terminals. Mr. Bowden is travelling via New Orleans and Cuba to Cristobal and will be away for about five weeks.

*

Walter J. Francis, M.E.I.C., recently re-elected vice-president of *The Institute*, who is one of the best known engineers in Canada, is rapidly convalescing from a serious illness continuing over eight months. The assurance from Mr. Francis that he expects at an early date to resume his engineering practice in Montreal will be heard with satisfaction by his many friends in *The Institute.*

*

F. B. Tapley, M.E.I.C., Member of Papers' Committee, Moncton Branch, assistant engineer of Maintenance of Way, Canadian Government Railways, Moncton, has been promoted to the position of engineer of maintenance of way, Canadian Government Railways, Eastern Lines, with headquarters at Moncton. Mr. Tapley's promotion is a well deserved and popular one.

*

R. B. Young, A.M.E.I.C., delivered a lecture recently before the Boston Society of Civil Engineers on "New Methods of Proportioning Concrete in Theory and Practice". Mr. Young is in charge of engineering materials and chemical division of the Hydro-Electric Power Commission of Ontario, he is a member of the Canadian Engineering Standards Association and an authority on concrete practice.

G. Gordon Gale, M.E.I.C., recently elected President of the Canadian Electric Railway Association, was born in Quebec, in 1882, and was educated at McGill graduating with the degrees of M.Sc.

G. Gordon GALE, M.E.I.C., Chairman, Canadian Electric Railway Association

After experience as assistant to the underground manager of the Caledonia Mine, Dominion Coal Company, during which time Mr.Gale had charge of mine surveying, design, installation and repair of equipment, he was for two years assistant engineer with the Canadian Rubber Company, later being resident engineer for Messrs Ross and Holgate.

Since 1907, Mr. Gale has been associated with the Hull Electric Company, first as superintendent, later as general superintendent, general manager and vice-president.

*

Winner of Plummer Medal

Dr. Stansfield who has been awarded the Plummer Medal for 1919 for his paper on "Electric Furnaces", was born at Bradford, England on March 18th, 1871, and was educated at London University, from which he later obtained the degree of D.Sc. For eight years following 1890 Dr. Stansfield was assistant to Sir Wm. Roberts-Austen at the Royal Mint, London, he was then appointed to take charge of the metallurgical and assaying laboratories of the Royal College of Science, London, which post he held until being appointed Professor of Metallurgy at McGill University in 1901. For almost twenty years

Dr. Stansfield has been connected with the staff of McGill University, and is now Birks Professor of Metallurgy and head of the Metallurgical Department.

Alfred STANSFIELD, M.E.I.C., D.Sc., F.R.Sc.

Dr. Stansfield is well known for his able research work, for the Dominion Government he made an exhaustive study of electric smelting of iron Sweden, he has also made extensive experiments in electric smelting of zinc and the production of zinc oxide paints at Shawinigan Falls. As a member of the Government Commission appointed in 1915 by the Minister of Militia and Defence Dr. Stansfield reported on the copper and zinc possibilities in connection with shell production. In addition to his University and consulting work Dr. Stansfield has taken his share in the development of the Canadian technical press, being editor for the first two years, (1918-1919) of "Iron and Steel". He was elected an Associate, Jan. 14, 1904. Transferred to Member, Oct. 22, 1918.

*

Winner of Gzowski Medal

R. deL. French, M.E.I.C., was born in North Brookfield, Mass., in August 1885. He graduated in 1905 from Worcester Polytechnic Institute, joined the staff of Prof. Malverd A. Howe at Terre Haute, Ind., and assisted in the revision of Prof. Howe's "Treatise of Arches" and in the design and construction of concrete arch bridges. After two years in a post-graduate course at Worcester Polytechnic Institute when he obtained the degree of C.E. Mr. French was appointed engineer by the Sewage Commission of Louisville, Ky.. in connection with a $4,500.000 sewer construction project.

R. de L. FRENCH, M.E.I.C.

In 1910 Mr. French became engineer for the National Concrete Construction Company of Louisville, and in 1911 was engaged as principal assistant engineer by R. S. and W. S. Lea, consulting engineers of Montreal. During his connection with this firm, Mr. French was engaged in important work for several Canadian municipalities in connection with sewage plants, waterworks, etc. In 1918 Mr. French resigned to accept an appointment with Arthur Surveyer, M.E.I.C., consulting engineer, but was asked to undertake the engineering work of the Lignite Utilization Board upon the formation of this Board later in 1918. Mr. French's work in connection with the Lignite Utilization Board has been of great value, not merely to the engineering profession in Canada, but to the Dominion at large; the development of an important natural resource being of prime importance, and the successful issue of the researches of the Board being due largely to the painstaking work of Mr. French. In addition to his professional work, Mr. French has been a lecturer in municipal engineering at McGill since 1911, and has been identified for several years with the movement for better housing and town-planning conditions in Canada. Mr. French was elected an Associate Member of *The Engineering Institute* in March 1913, and transferred to Member in October 1918. Mr. French has been awarded the 1920 Gzowski Medal for his paper on "Design and Construction of Reinforced Concrete Covers for Reservoirs".

BRANCH NEWS

Victoria Branch

H. M. Bigwood, A.M.E.I.C., Secretary.

H. L. Johnston, M.E.I.C., a member of the Branch, the district engineer for the Vancouver Island Division of the Canadian National Railway system was elected a Councillor of *The Institute* at the Annual Meeting.

The monthly luncheon, now become a regular and popular feature of Branch activity, held on Saturday, February 5th, was attended by about thirty members. The speaker for the occasion was Dr. Plaskett, director of the Dominion Government Astrophysical Observatory at Saanich.

At the regular meeting, Wednesday, February 9th, a paper on "Light Railways in France" was given by H. Peters, A.M.E.I.C. The small attendance, not quite as good as usual, owing to the exceptionally adverse weather conditions which prevailed, did not detract from the interest shown by those attending. The speaker, who seasoned his remarks with humourous anecdotes which gave a realistic touch to his descriptions of the work done and the methods adopted under circumstances far from ideal. The paper was much appreciated by all present and considerable discussion followed.

A visit was made by the branch to the shipbuilding plant of Messrs. Yarrows Ld. at Esquimalt, on Friday, February 11th, by invitation of Norman Yarrow, A.M.E.I.C. The different work in hand was viewed and operations and methods explained to the visitors.

Vancouver Branch

J. N. Anderson, A.M.E.I.C., Secretary-Treasurer.

The Vancouver Branch has decided to hold mid-day luncheons at which eminent visiting engineers will be the guests of honour and at which short addresses will be given.

The first luncheon was held on Wednesday, 9th. February in the Blue Room, Hotel Vancouver, when Thomas Adams, F.S.I., town planning adviser to the Commission of Conservation was the principal guest and delivered a most interesting address on "Town Planning".

Major G. A. Walkem, M.E.I.C., was in the chair, and included in the forty-five who were present were representatives of the B.C. University Senate, the B.C. Architectural Institute and other technical bodies.

Mr. Adams emphasised the responsibility of the municipal engineer in relation to the building of Cities and declared that the duties of municipal engineers should be to prevent mistakes, not to correct errors. There was in Canada a lack of proper appreciation of the position of the engineer in the general order of things. There was not sufficient appreciation of what his responsibilities should be in guiding policies instead of correcting mistakes. Too often he was ignored for the purpose of political expediency. This lack of proper appreciation was partly due to the engineers themselves, and could be largely removed by proper organization.

The chaos in Canadian city building was due to haphazard development. Engineers in the early days were not so much interested in cities as in harnessing and controlling nature. Their work in this regard had, however, resulted in the creation of cities and large communities. The engineers' responsibilities did not, however, stop with industrial service. There was a social aspect. They should go further and develop the cities and towns they assisted in creating.

The speaker mentioned many of the errors which amateurs had caused engineers to commit, and spoke strongly on the need in British Columbia of a town-planning law. He pointed out the broad benefits which would be derived from such legislation, and then went into some detail on the matter of selection and development of regional community areas. Vancouver was in great need of intelligent direction and examination because of its combination interests of port, industrial and agricultural development.

The preliminary to all town planning should be proper preparation of topographical plans in order to lay out a city in such a manner that drainage and natural conformity of ground could be utilized to the best extent. Judgment should be exercised in selection of lands for buildings. None should be used that was unsuitable. Land must be suitable for building before the owner could sell. There should be an absolute prohibition of selling bog or muskeg land which could never be good building ground until drained properly.

The building of cities should be carried on with due regard to arterial roads feeding the centres. There was much that could be done in Vancouver yet, in spite of the building that had been done. No growing city was without need of town planning.

In summing up Mr. Adams made the striking comment that the engineering profession, though it had subdued and harnessed the great forces of nature in this vast Province, had yet been unable to overcome the politicians and others who, from selfish motives, were capable of undermining and putting aside the technical advice of those trained to direct the planning and development of the country and its cities.

Calgary Branch

A. L. Ford, M.E.I.C., Secretary-Treasurer.

On the 21st of January a meeting of the Branch was held at the Board of Trade rooms. This was the first meeting of the Branch year at which business could be transacted as the December meeting had been a public meeting.

In addition to the routine business the vote on two amendments to the bylaws were received and counted. Both amendments passed by large majorities. The first changed the date of the annual meeting from the first Saturday in December to the second Saturday in March.

Under this bylaw the present executive continues in office until March, 1922. The second bylaw provides that applications for admission or transfer shall be voted on by the Executive instead of by the Branch assembled in general meeting.

After the business had been completed, B. L. Thorne, M.E.I.C., of the local Mines Branch, Dept. of Natural Resources, C.P.R., gave a very interesting resumé of his trip into the Lac La Ronge District of Saskatchewan during August, 1920. Mr. Thorne accompanied officials of the Saskatchewan government into this district, leaving Prince Albert, Saskatchewan on August 3rd and proceeding by way of Montreal Lake and River, Partridge, Crop Lake, Starving Lake, Egg Lake and Big Stone Lake to Lac La Ronge. From there the party proceeded to Bow River and Wapaweeka Lake, at the first of which points bituminous shale outcrops and at the second coal outcrops were examined. The whole trip was a natural resources reconnaissance.

While no discoveries of great value were made Mr. Thorne's description gave the members an excellent idea of the country passed through.

Smokeless Powder

On February 4th the Calgary Branch welcomed members of the Calgary Branch of the Alberta Military Institute at a joint meeting and listened with great interest to a talk by G. N. Houston, M.E.I.C., Chairman of the Calgary Branch, on "Smokeless Powder". The talk was illustrated by a large number of slides covering the construction of a large plant built in 1918 by the United States government in West Virginia.

Mr. Houston introduced the description of this particular plant by remarks that the fundamental requirement in the manufacture of all explosives is fixed nitrogen. The element nitrogen is one of the most widely distributed elements present on the earth, comprising some four fifths of the atmosphere, but so reluctant is it to combine with other elements, and thus take on a "fixed" form, that for ages, the world has been dependent on supplies already fixed in some natural way. Of the natural fixed nitrogen the greatest known supply comes from Chile in the form of saltpetre or sodium nitrate.

Before the war students of chemistry visiting Germany found German chemists engaged in the effort to find ways of transforming ammonia into nitric acid. This effort seemed strange, as at the time ammonia was more expensive than nitric acid, but when war came and cut off from Germany all outside sources of saltpetre. German chemists had arrived at methods of manufacturing ammonia synthetically and were able to continue the process until nitric acid was evolved and had thus solved the problem of fixation of atmospheric nitrogen. They were able to produce this fixed nitrogen in such quantities as to keep up the manufacture of explosives after the British blockade had entirely stopped imports of saltpetre.

By a diagram the chemical affinities of nitrogen were explained and some of the nitrogen compounds illustrated such as nitrogen iodide, a very unstable compound which detonates violently with a slight jar, while nitrates of cellulose and some other carbohydrates are more stable and can be handled with little danger, it being possible to fire a rifle bullet into T.N.T. (trinitro toluol) without serious danger of exploding it.

Going on into a description of the plant in West Virginia, Mr. Houston presented slides showing the general layout covering 1700 acres, where aside from the plant itself, buildings were put up to house a city of 30,000 people; 20,000 people were engaged in construction of the plant and it required some 10,000 persons for its operation when completed. The plant was designed to produce 750,000 pounds of powder per day. In the plant various operations were carried out in different areas, each area being designated by a characteristic letter.

Process diagrams were shown illustrating graphically each separate process, and these were followed in each case by photographs of the buildings and machinery that carried out the process.

The source of nitric acid in this plant was Chile saltpetre, delivered by standard gauge railway at the nitric acid plant. After manufacture into acid, it was conveyed by special pipes to tanks provided with weighing arrangements so that the mixture with sulphuric acid, made in other factories on the grounds, could be attended to without exposing either acid to the air.

Cotton was the material to be combined with nitric acid in this plant, and the processes of treatment of the cotton were very clearly illustrated and the number of processes necessary to remove impurities and bring it to a consistency which would enable a uniform nitrification to result, was startling to the layman. There was washing, bleaching, washing again, and drying. When the cotton finally was ready for nitrating it was in a fluffy mass and contained a very low water content, only a fraction of one per cent of the weight. Batches of about 15 pounds of cotton were then put into receptacles containing nitric and sulphuric acid, and the time of treatment watched very carefully, as the proper time was a trade secret and governed the chemical constituency of the finished product. As accidents were likely to occur at this stage, chutes were provided to permit of quick exit of the workmen from the building and special ventilators to remove gases from the place. Sulphuric acid present in the bath did not enter into chemical union with the cotton, but by its affinity for water it removed water present in the cotton or given off in chemical dissolution of cellulose.

After nitration, the product is put through a long boiling and pulping process to get rid of the by-products of nitration, after which it comes out a pure nitro-cellulose.

The next process is colloiding. Hydraulic presses remove the water, after which alcohol is admitted to the press, and in turn the surplus alcohol removed by pressure. The nitro cellulose now looks like a cheese, and is partly saturated with alcohol. The block is now broken up and put into a mixer into which ether is introduced. The alcohol and ether dissolve the nitro cellulose (or pyro-cotton) and the colloid mixture is brought to a solid state by another press. It is then forced through a "macaroni" machine, issuing as tubes very similar to macaroni, but provided with multiple holes instead of a single large hole through the middle.

These strings are next cut into short lengths and the product dried, recovering surplus solvent for use again. Finally a number of batches, each of which had been tested chemically at various points in the manufacture, were taken to a blending tower and thoroughly mixed, and then packed for shipment.

On the grounds were proving ranges where sample lots of powder were used to fire a projectile from a field gun, apparatus being provided for measuring muzzle pressures, and velocities of the projectile.

The water supply for the plant was an intricate affair with a capacity of about 70 million gallons per day. The river near which the plant was located was subject to sudden rises of as much as 40 feet, and the water was frequently muddy and contaminated by sewerage. Large amounts of water were required in the plant as well as for the city of employees and their families, and a filtration plant of 40 million gallons per day capacity was built. The system was constructed with mains both for filtered water for manufacturing and fire protection and for raw water for condensing and cooling purposes.

Organization diagrams explaining the chain of responsibility emphasized the intricate scheme necessary to direct a work of such magnitude.

At the time the armistice was signed the plant was not yet complete, only three units out of seven being actually in use for the manufacture of powder. The plant cost about 60 million dollars and was sold shortly after the close of the war for 8½ million and is not used for powder manufacturing now.

Quite a spirited discussion followed the paper, and at the conclusion of the discussion, Lt.-Col. G. R. Pearkes, V.C., D.S.O., M.C., spoke on behalf of the Military Institute.

Col. Pearkes pointed out that in the dark days of 1915 and 1916, the men in the field wondered why our guns could fire only a few rounds a day while the enemy was firing thousands of rounds, but after hearing and seeing what an intricate process was necessary to produce just one portion of the requirements of a round from a gun, it is not so hard to understand why there was so long a delay in delivering munitions to the troops in the field.

Winnipeg Branch

Geo. L. Guy, M.E.I.C., Secretary-Treasurer.

P. Burke-Gaffney, A.M.E.I.C., addressed the meeting held on February 17th, on "Highway Bridges in Manitoba". The speaker discussed the subject from the point of view of what had been done in the way of bridge construction in the Province during the last decade. He explained that, previous to the passage of the Good Roads Act in 1914, there were practically no permanent highway bridges in the Province, but since then close on 600 structures had been built under the provisions of that Act. He dwelt at some length on the Act and brought out the point that the idea back of it, contribution from the consolidated revenue of the Province towards the construction of bridges, was fundamentally equitable, since any improvement in the means of locomotion, any abridgement of distance is not merely of local benefit but is of benefit to the community as a whole in so far as it decreases the cost of production, promotes social intercourse, and quickens the economic life of the nation. He then outlined the special difficulties confronting the bridge engineer in Manitoba, and showed how topographical features combined with the unusual labour and material conditions which obtained during the war had modified existing practice in design and led to the development of unusual variation in concrete bridge construction. A large number of lantern slides were shown illustrating these various types, together with the standard types of steel, concrete and timber bridges, adopted by the Good Roads Department. In the discussion which followed, the speakers were unanimous in commending Mr. Burke-Gaffney's attitude in dwelling not only on the successes but on the failures which are probably a more fruitful source from which lessons may be learned.

Border Cities Branch

J. E. Porter, A.M.E.I.C., Secretary-Treasurer.

The regular monthly meeting of the Branch was held in the auditorium of the Chamber of Commerce on Friday evening February 11th.

The minutes of the last meeting were read and adopted, and correspondence read and discussed.

The speaker of the evening was Professor T. R. Loudon, M.E.I.C., of Toronto University. The subject of Engineering Education was dealt with by the speaker in a very instructive and interesting manner. Professor Loudon reviewed the trend of education as shown by attendance records of Canadian Universities for the past ten years, illustrating by graphs prepared from Toronto University. These graphs showed a peak in 1910 and a low point during the war, which in turn was followed by a sure peak last year. What becomes of the engineering graduate was also shown by interesting figures.

Following Professor Loudon's address, some time was spent in commenting on Engineering Education, by several members.

J. E. Porter, A.M.E.I.C., made a brief report of Ontario Provincial Division Meeting at Toronto on Feb. 3rd, and J. C. Kent, A.M.E.I.C., and A. J. Bowman, A.M.E.I.C., made brief reports of the General Professional Meeting at Toronto.

Hamilton Branch

J. A. McFarlane, M.E.I.C., Secretary-Treasurer.

A general meeting of the Branch was held on Friday evening, January 28th in the Assembly Hall, Hamilton Public Library and in the absence of Mr. Hart the chair was taken by E. H. Darling, C.E., Vice Chairman of the Branch.

This meeting was well attended and after some routine business had been disposed of Willis Chipman, M.E.I.C., of Toronto, gave an address on Engineering Legislation and the draft Bill. He gave a very interesting historical sketch of engineering in Canada tracing its development up to the present time and also the various steps leading up to the present bill which he explained at some length. A general discussion followed which brought out clearly many phases of the Bill and among those leading in the discussion were Messrs. Gray, Palmer, Tyrrell, Darling, Adams, Ogilvy and others. A vote of thanks of the meeting was tendered to Mr. Chipman for his excellent address.

The following resolution was carried unanimously by the meeting:—Moved by Messrs. Tyrrell and Ogilvy and resolved: "That the Hamilton Branch E.I.C. is in favour of the Bill as drafted and suggests that every reasonable efforts be made to have it put through at the present session of the House."

On motion of Messrs. Tyrrell and Gray the following resolution was carried:—"That a vote of thanks of the Hamilton Branch E.I.C. be extended to Willis Chipman, M.E.I.C., and J. B. Challies, M.E.I.C., the representatives of the E.I.C. on the Joint Conference Committee for their splendid efforts and sacrifice of time in the preparation of draft bill for Engineering Legislation in Ontario. The Secretary was instructed to send a copy of this resolntion to both gentlemen.

The meeting elected E. H. Darling, M.E.I.C., Vice Chairman of the Branch as their representative on the Nominating Committee for Council for the present year. J. W. Tyrrell, M.E.I.C., was elected delegate to the Town Planning and Housing Conference meeting in Toronto on Feb. 17th and 18th and Mr. Tyrrell was requested to have his report ready for the March meeting.

The following resolution adopted by the Toronto Branch, was on motion of Messrs. Paulin and Palmer, adopted and the Secretary instructed to write the general secretary in regard to same:—

Resolved "That the Council be respectfully requested to institute some arrangement by which members who have occasion to transfer from one local Branch to another can obtain from the Secretary a letter or card of transfer and a duplicate be sent by post to the local Branch to which the transfer is made."

Messrs. Dwight and Darling were appointed a Committee to make all arrangements for the March Meeting. The speaker will be Jas. J. McKay and his subject will be Town Planning with special reference to the City of Hamilton.

New Achievements in Radio Engineering

S. M. Kintner, vice-president of the International Radio Telegraph Co., delivered an able address in Hamilton, February 18th, on the subject "Progress and Achievements in Radio Engineering", before a joint meeting of the Hamilton Branch of *The Engineering Institute of Canada* and the Toronto Branch of the American Institute of Electrical Engineers. The attendance was 175.

Mr. Kintner told of the new radio telephone service recently inaugurated by his company. They are now sending broadcast from Pittsburgh, Pa., at stated hours, musical concerts, news items and weather and market reports. This service is chiefly for the benefit of those having private or amateur radio outfits, and is sent by radio telephone, so that a knowledge of the Morse code is not required. The news items and reports reach country districts many hours before the nearest daily newspaper. The musical selections are sometimes specially rendered for this service by artists or orchestras, and sometimes the selections are the direct telephone transmission of public concerts being given in the City of Pittsburgh. Every Sunday evening the complete service of a prominent church in that city is sent out, including the musical anthems and the sermon. This has been listened to by private radio instruments as far away as Texas, Maine and Ontario.

It is evident that the day has already arrived when every member of the household of a country residence can listen directly to what is going on in the city, and it is easy to foresee the time when houses will have, besides a gramophone for entertainment, a wireless telephone for both news and entertainment.

Mr. Kintner stated that there are now seventeen trans-Atlantic cables, nine of them being over thirty-five years old and therefore approaching their limit of useful life. Each of them cost many millions of dollars, but his company is now building a transatlantic radio station for about one-fifth of the cost of a submarine cable. A modern transatlantic radio station can now be said to be able to work every day in the year.

The railroads are considering radio telephones seriously, partly for regular train dispatching and partly for the new feature of speaking directly to the locomotive driver of a moving train, thus providing additional safety.

At the close of his address, Mr. Kintner answered many questions propounded by the radio enthusiasts in the audience. The meeting concluded with an informal reception for the Toronto delegation and the guests from the Hamilton Technical School, who attended in considerable numbers.

Toronto Branch

H. A. Goldman, A.M.E.I.C., Secretary-Treasurer.

After the period of activity which resulted from the Annual Convention of *The Engineering Institute of Canada*, being held in Toronto on Feb'y 1-3rd, the members of the Branch have once more settled down to the usual business.

Toronto Gas Works

Feb'y 10th — An open meeting was held in the Mining Building with R. O. Wynne-Roberts, M.E.I.C., Chairman of the Branch, presiding. The subject of the evening was "The Toronto Gas Works" Illustrated.

Arthur Hewitt, general manager of the Toronto Gas Works, addressed the Branch on The Toronto Gas Works. He gave a brief historical survey of the gas industry, tracing it through all stages of development. In dealing with the methods of manufacture of coal and water gas he brought out the difficulties connected with each.

The complete equipment and operation of the plant of the Toronto Gas Works was illustrated by lantern slides.

The Gas Works as a publicly controlled corporation was discussed by the speaker.

To those members who had the privilege of visiting the plant, this lecture supplied the necessary supplementary information.

A hearty vote of thanks was accorded to Mr. Hewitt before the meeting adjourned.

Forms for Concrete Work

Feb'y 17th — T. T. Black, A.M.E.I.C., in his address to the members of the Branch on "Forms for Concrete Work" gave some of the results of his long experience as an engineer and contractor. In discussing the economics of form work, he pointed out the necessity for co-operation in design between the engineer and the contractor. There are many practical details in form work usually overlooked, which could be taken care of in the original design, and which would result in economy on the job.

He stated that the flowability of concrete depended on the temperature of the mix and the humidity existing at the time of pouring. Also he found that with concretes of coarse aggregate, the addition of a small amount of fine limestone screenings increased the flowability without decreasing the strength. He said that liquid pressure on forms depended on the temperature at the time of pouring.

Frank Barber, A.M.E.I.C., referred to form work for concrete bridges and stated that in his opinion all form work for important works should be designed by the engineer and not left to the contractor. He had found that the use of definite specifications for form work was necessary.

T. D. Mylrea, A.M.E.I.C., in discussing the form work for columns in buildings, said that greater economy could be secured by having the columns on each two consecutive floors of the same size, as the saving in form work would more than offset the small increase due to extra concrete.

C. R. Young, M.E.I.C., G. A. McCarthy, M.E.I.C., F. B. Goedike, A.M.E.I.C., also took part in the discussion.

A hearty vote of thanks was accorded the speaker of the evening.

Report of Annual Meeting Publicity Committee

The amount of publicity received for *The Engineering Institute's* Annual Meeting, in the newspapers of Toronto, is shown by the following table, outlining the number of inches devoted to the proceedings of the meeting in the issues indicated.

	Globe	*Mail*	*World*	*Star*	*Telegram*
Jan. 29	5				
31	4			12	
Feb. 1					12
2	10	16	18	10	
3	32	55	24	6	16
4	14		26		
Totals...	65	71	68	28	28

Grand total..260

The total amount of space, 260 inches, represents 13 columns. It is readily seen that the morning papers have been mostly interested in the meeting, as their combined reference to it amounts to 207 inches, or 10 columns. The evening papers, on the other hand have given over only 56 inches, or 3 columns.

J. R. W. AMBROSE, M.E.I.C., Chairman, Publicity Committee, Annual General Meeting, 1921

We might say that it was with some difficulty that the editors of the newspapers were interested in the convention, and it took persistent efforts to induce them to send responsible reporters. However, as indicated before, the editors of the morning papers were more willing to offer co-operation. The disinterested attitude of the evening papers was, in all probability, due to the fact that by the time they got the news, it was 24 hours old. It is the tendency, also, on the part of the newspapers, to reject any prepared write-ups, especially if they are at all lengthy. It does not seem to be the attitude of the Toronto newspapers to encourage the insertion of prepared publicity matter, unless it is boiled down to the barest news facts. Efforts to have advance information published were somewhat disheartening, as, unless the editors could see some news interest in the articles, they were prepared to reject them as being free puffs.

Taking the matter as a whole, however, we believe that the amount of publicity secured by *The Institute* was entirely satisfactory and there is no doubt but that the general public of Toronto realized more than ever before the nature of the organization and are more sympathetic with the engineering profession. We wish to take this opportunity of acknowledging the co-operation of the papers, their editors and reporters, and also the editors and publishers of the technical and trade papers, who were represented at the meeting and will give publicity to it in their respective publications.

J. R. W. AMBROSE,
Chairman, Publicity Committee.

Peterborough Branch

R. L. Dobbin, M.E.I.C., Secretary-Treasurer.

The meeting of the Branch on January 13th, was addressed by P. S. Gregory, M.E.I.C., of Montreal, electrical engineer for the Shawinigan Water and Power Company.

Mr. Gregory's subject was "Power Developments on the St. Maurice River", and it was treated under the following heads: (1) A discussion of the preliminary investigations carried out before the construction of La Loutre Dam; (2) A description of the design of No. 2 Power House at Shawinigan Falls; (3) A discussion of some of the troubles which develop in the operation of the generators and the system of relay protection employed to avoid their repetition.

Mr. Gregory also described the results obtained by the use of the regulation dams, and the improvement in the amount of power manufactured.

The address was illustrated with three reels of moving pictures of the developments at Shawinigan Falls and the industries established there.

F. T. Kaelin, M.E.I.C., chief engineer of the Shawinigan Water and Power Company accompanied Mr. Gregory, and assisted in the discussion.

William Gore, M.E.I.C., of Toronto was the speaker at the regular meeting on February 10th. His subject was "Reservoirs" and included a description of very many of these structures.

Mr. Gore traced the history of reservoirs back to the ancient Egyptians, where they were first used for irrigation purposes. He showed by means of lantern slides the construction of many of the famous dams of the world, and referred to the disasters that had resulted from faulty designing and workmanship.

Mr. Gore also briefly touched on the mathematics of the design of dams and reservoirs.

An extra guest of the Branch at this meeting was K. H. Smith, M.E.I.C., of Halifax, chief engineer of the Nova Scotia Hydro Electric Power Commission, who was in the city on business.

Mr. Smith addressed the gathering and described the progress and prosperity of Nova Scotia in general and the City of Halifax in particular. He also drew attention to the growing dissatisfaction in the Maritime Provinces with their treatment since Confederation. Coming from an engineer of Mr. Smith's prominence his message carried great weight, and brought home a new viewpoint to the minds of those present.

Mr. Smith's clear cut exposition of the state of politics in Nova Scotia and in Canada generally is an indication of the way in which engineers are broadening out and becoming citizens in the truest sense.

Ottawa Branch

F. C. C. Lynch, A.E.I.C., Secretary-Treasurer.

That the last stage of engineering progress in the propulsion of ships that has marked the past 100 years as the century of the Engineers had been reached with the "Electric drive," was the outstanding statement in an able lecture on "Ship Propulsion," delivered by Engineer Commander T. C. Phillips, M.E.I.C., chief engineer of the Naval Department, before the Ottawa Branch of *The Engineering Institute of Canada*, at Victoria Museum. The lecture was attended by a large and appreciative audience. Lt.-Commander C. P. Edwards, A.M.E.I.C., Chairman of the Ottawa Branch, was in the chair.

Commander Phillips briefly touched on the various methods of propelling ships from 2,000 B.C. when the ships of the Egyptian Navy were propelled by oars, to the year 1801 when the steam engine was applied afloat as motive power with the "sailing" of the "Charlotte Dundas" on the Clyde. He sketched the later development to the steam turbine and electrically driven ships of the present day which included the world's largest warship, the British battle cruiser "Hood" of 45,000 tons.

Commander Phillips dealt at length with the various types of engines, and explained very clearly the principles governing each type of engine. He described the gradual development of the steam engine as used afloat until today when "the adoption of the steam turbine in the British navy is complete."

Dealing with the innovation of electrically driven ships, Commander Phillips stated there was some doubt as to the origin of this method of propulsion, but the honor for its adoption in capital war ships rested with the United States naval authorities. The development of this method of ship propulsion on so colossal a scale was a tribute to their initiative.

In conclusion, Commander Phillips remarked that the race was now on between geared turbines and electrically driven ships, with the Diesal engine as a lively youngster, entering the competition with immense potentialities in the matter of efficiency and economy.

The motion pictures of the United States war ship "New Mexico," and the Canadian navy were excellent. This film was loaned by the General Electric through the courtesy of Senator Nicholls.

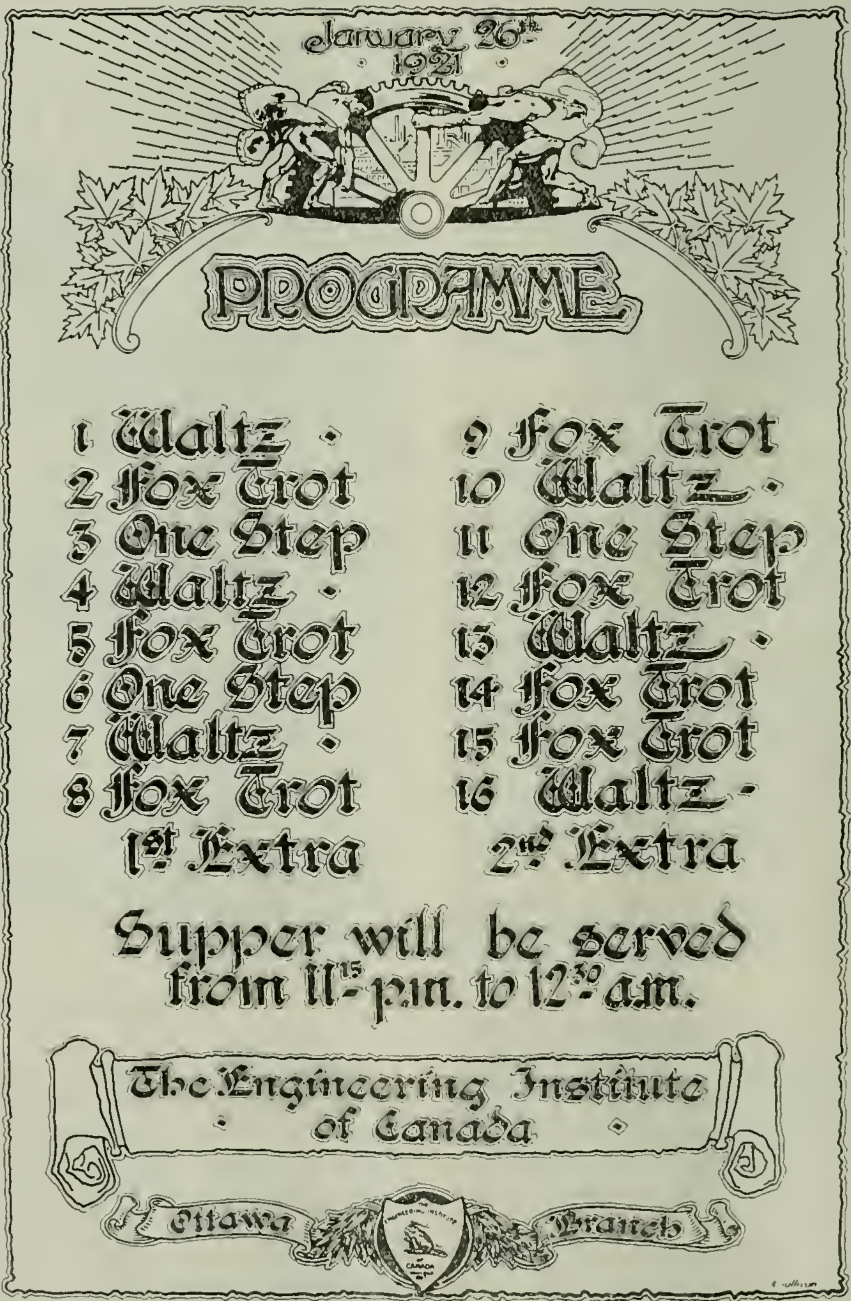
Engineers' Ball

Under the distinguished patronage of Their Excellencies the Governor-General and the Duchess of Devonshire, the Ottawa Branch of *The Engineering Institute of Canada* entertained the members and their friends to a very delightful dance on Jan. 26th. J. B. McRae, M.E.I.C., arranged for this enjoyable affair. The chaperons, the first three of whom received the guests at the entrance of the foyer, were: Mrs. C. P. Edwards, Mrs. G. J. Desbarats, Mrs. George Mountain, Mrs. J. F. Crowdy, Mrs. Gordon Gale. The dance was one of the jolliest gatherings the Chateau has ever witnessed. An excellent orchestra was in attendance.

"Cements and Supercements" was the subject of a very interesting and instructive illustrated lecture delivered by Capt. F. M. Dawson, A.M.E.IC., at a largely attended. joint meeting of *The Engineering Institute of Canada* and the Society of Chemical Industry in the public library Jan. 10th. E. Viens, chief chemist of the Department of Public Works, also reviewed progress in the cement industry in recent years.

Although known as a scientific fact as early as 1910, supercement was not developed until 1915, Capt. Dawson stated. During the war, the manufacture of supercement was commandeered by the British Admiralty for use in building aerodromes, and the industry was not commercialized until after the war. The addition of a "cata-coll" to ordinary cement, rendered it much more durable, and water-proof, owing to complete hydration.

Lantern slides were used to illustrate the advantageous qualities of supercement. It was introduced in Canada in 1919, and its use in construction is rapidly developing.



January 26th
1921

PROGRAMME

1 Waltz
2 Fox Trot
3 One Step
4 Waltz
5 Fox Trot
6 One Step
7 Waltz
8 Fox Trot
1st Extra

9 Fox Trot
10 Waltz
11 One Step
12 Fox Trot
13 Waltz
14 Fox Trot
15 Fox Trot
16 Waltz
2nd Extra

Supper will be served
from 11^{15} p.m. to 12^{30} a.m.

The Engineering Institute
of Canada

Ottawa Branch

Ottawa Branch, Dance Programme, January 26th

Montreal Branch

J. L. Busfield, A.M.E.I.C., Secretary-Treasurer.

The Branch meetings have been held regularly every Thursday evening during the past month with the usual attendance overflowing the seating capacity of the Hall· On January 27th an extremely interesting and valuable paper by H. S. Van Scoyoc, A.M.E.I.C., was read on the Construction of the Toronto-Hamilton Highway (printed on page 159.) The author not only dealt with the Toronto-Hamilton highway but also referred to general concrete highway construction and during the discussion in which a great many took part, many interesting points were brought out. The paper was not only illustrated with excellent lantern slides but also with a number of moving picture films, two of each were of the Toronto-Hamilton highway, while others were of concrete road construction. A. C. Tagge, M.E.I.C., presided.

On February 3rd two papers on the subject of wood preservation were read by Messrs Blair and Coderre, of the Forest Products Laboratories of Canada. In discussing the cause and prevention of decay in structural timber Mr. Blair said that timber decay had been looked upon as a mysterious and inevitable calamity. It could be avoided, however, if wood was handled in a proper manner, long and satisfactory service resulting. More than 50 per cent of the railway ties in Canada were of hemlock and Jack pine and the average life of these ties was six or seven years. Poles for telephone and telegraph service and fence posts rotted at the ground. Timbers in moist unventilated basements of buildings often lasted for only a few years and a very limited service was obtained from roof timbers of buildings which had a moist occupancy. Conditions had been studied at more than a hundred pulp and paper mills in Canada and the United States. The majority of these mills had wooden roof deck, and of this number but a very few had had no trouble with decay in roof timber.

Decay in wood was a condition produced by fungus plants, which fed upon the substance of the wood, which might, however, be protected against the attack of these organisms in one of two ways. Either the plant could be starved by withholding the moisture which it requires, or else its food supply could be poisoned by the use of a wood preservative in the timber. The preservatives commonly used were creosote oils and water soluble chemicals, such as zinc chloride, mercuric chloride, or sodium fluoride. In order to be sufficient the preservative must reach the fungus plant and kill it. A preservative treatment would be of no use where the timber remained permanently dry.

Mr. Coderre dealt with the details of a number of treating processes, explaining very fully the advantages and disadvantages of each system. The two papers were followed by an interesting discussion opened by Mr. Wallace, a leading architect of Montreal, who told the meeting some of his personal experiences with dry rot.

The meeting on February 10th, was devoted to a series of motion pictures loaned to the Branch through the courtesy of the Air Board of Canada, through the activity of Doctors Porter and Eve, of McGill University. The pictures were most enthusiastically received by the large audience and were not only of general interest but were also in many ways very instructive.

On February 17th, A. H. Morse, managing director of the Marconi Company, gave a talk on Radio Telegraphy and Telephony punctuated with actual demonstrations of the wireless transmission of speech and music. The speaker stated that the title of his address might well have been "The wireless transmission of energy" because that was the business of wireless engineers of to-day and would continue to be their main objective until such time as it was possible to transmit over any distance more energy than was required for signalling purposes. Canada had always been in the lead in the application of wireless telegraphy and its transatlantic wireless service in competition with the cables was daily growing in popularity as it was continually improving in speed and accuracy. The wireless telegraph service on the Great Lakes, in the Gulf of St. Lawrence and on the Atlantic and Pacific Coasts was second to none in the opinion of the speaker. G. H. Burnett, A.M.E.I.C., Chairman of the Papers and Meetings Committee presided, and the paper was followed by an inspection of the various apparatus that Mr. Morse had used in his demonstrations.

St. John Branch

Harry F. Bennett, A.M.E.I.C., Secretary-Treasurer.

A special joint meeting of the St. John Branch and the Canadian Club was held in Bond's Restaurant on January 25th. The special guest of the evening was John Murphy, M.E.I.C., of Ottawa. A. M. Belding, editor of the St. John Times and president of the Canadian Club occupied the chair and about 80 members of the two societies were present.

After supper was served, Mr. Murphy gave his interesting lecture on "Ice Formation and Prevention" illustrated with motion pictures and lantern slides. The natural phenomena illustrated in the pictures and so ably described by Mr. Murphy were a revelation to those present. He first showed the loss of power resulting from the formation of frazil ice at the plants on the Ottawa River and various methods which had been used for its prevention. He showed, with the aid of the pictures, the actual manner in which ice was formed by agitation at the critical temperature and the method he advised for its prevention.

At this time when Hydro-Electric Development is a live issue in New Brunswick, the lecture and illustrations gave those privileged to be present a more intimate knowledge of problems which may arise in the future, and the methods which have been advocated to prevent them.

At the conclusion of the lecture, the thanks of the meeting was extended to Mr. Murphy by the Chairman, after which many questions were asked relating to the subject.

The following clipping from the St. John Times of January 27th. is of some interest:—

"Hiram," said the Times reporter to Mr. Hiram Hornbeam, "I listened to an amazing picture talk the other night. A man from Ottawa showed us how ice forms and how you may stop if from forming. If you want open water all winter in the river out in the Settlement he can tell you what to do. I would not be surprised if he devises a plan to keep the St. Lawrence open all winter."

"You didn't let him git away—did you?" demanded Hiram.

"Get away?" said the reporter, "I don't understand."

"If he keeps the St. Lawrence open," said Hiram,—"Montreal'll be the winter port an' St. John wont git nothin'."

I'll give you three minutes," said the reporter, "to tell me what St. John is getting now."

"Well," said Hiram, "I don't know as it's much—but we're alwus gonto git somethin'—aint we?"

"Yes," said the reporter, "and we've been subsisting on that for a long time."

"Ever sence confederation," said Hiram. "I mind as well as if it was yisterday what our noospapers an' politicans said fifty year ago about all the trade o' the west comin' to St. John — an' how the Intercolonial Railroad wouldn't never be ast to pay its way — fer old Sir John Macdonald said so. We understood it was part o' the agreement. But it doesn't ony hafto pay its own way now, but it pays fer a lot more road that can't pay its own way. An' now here comes a feller that's gonto keep the St. Lawrence open all winter. Mister — I don't think we orto let him git away. He'll hev us trimmed to a frazzle."

"Frazil," corrected the reporter. "His specialty is dealing with frazil."

"An' we orto deal with him," said Hiram, "right now — By Hen!"

*

A regular meeting of the Branch was held in the City Hall on Feb. 17th. 1921, the speaker for the evening being F. P. Vaughan, M.E.I.C., who read his interesting paper on "Electric Welding of Iron and Steel" (which appeared in the December 1920 *Journal*). The paper was well illustrated by lantern slides.

Mr. Vaughan dwelt on the advances in electric welding, its use in replacing rivets in structural steel and ship building, and its adaptability in repairing locomotives etc. He proved conclusively that electric welding offers untold possibilities in all industries either for manufacture, repair, or maintenance, where steel or iron is used in any quantity.

Many members took part in the discussion and at the conclusion the thanks of the members were extended to Mr. Vaughan by the Chairman.

Moncton Branch

M. J. Murphy, A.M.E.I.C., Secretary-Treasurer.

A large number attended the meeting of the Moncton Branch held in the Assembly Room, City Hall, on January 26th.

W. A. Duff, M.E.I.C., Chairman, presided, and introduced the speaker of the evening, John Murphy, M.E.I.C., electrical engineer, Department of Railways and Canals, Ottawa, and consulting electrical engineer to the Board of Railway Commissioners for Canada, who delivered an address on "Ice Formation and Prevention" which was illustrated with slides and moving pictures showing graphically the formation of frazil and anchor ice, and its interference with water power machinery. Mr. Murphy strongly emphasized that it is no longer necessary for hydro-electric plants to be shut down in winter on account of ice clogging the water wheels. Years ago in Ottawa power plants were closed and cars stood in the streets owing to power being shut off by the formation of ice at the power plant. Since 1905 these troubles have been prevented simply by adopting means to raise the temperature of the metal parts slightly above thirty-two degrees, Fahrenheit freezing point, to prevent the formation of frazil. By utilizing this discovery, power houses need no longer close on account of ice.

Mr. Murphy contended that to avert expensive danger of water power machinery, easy and cheap methods would be used to raise the temperature of the machinery or water to a point where frazil or anchor ice would be avoided. "The simple fact is" he said, "That metal machinery below freezing point is an ice making machine, as the pictures show, and the only remedy is to either make the machinery above freezing point by steam or electric energy, or raise the temperature of the surrounding water. One ton of coal has prevented a 3,000 horse power plant from being shut down, while it requires 150 tons of coal a day to keep a steam plant of the same size, running.

Pictures were shown of the power plants at Ottawa and Hull, which had been closed down for many years in winter because of the formation of frazil with meteorological data showing the formation of ice in the Ottawa River for many years. The frazil which was fluffy, flaky portions of ice, gradually becoming congealed as it rose to the surface, was in a jellied state under water and the worst attacks occurred just as the water reached the freezing point. Under normal conditions once water attained the freezing point it would remain at that temperature during the whole winter.

It was not desirable to heat water or melt ice, but if the metal parts, such as the water wheels, were kept above the freezing point only one-thousandth of a degree this would prevent the formation of frazil.

Mr. Murphy showed pictures portraying laboratory experiments. In the motion pictures was shown a bottle where frazil was forming. There were two steel rods in the bottle one being just above freezing point and the other just below. The former remained clear as the frazil formed, but within a few moments the latter was covered with growing masses of ice.

The speaker also gave facts, to show how little prevented water from freezing. The St. Lawrence, at a given point, illustrated is 3000 feet wide, in fifty days of ice-forming weather the ice becomes two feet thick. A strip of ice one foot wide, two feet thick and 3000 feet long contains 6000 cubic feet. While these 6000 feet of ice were being formed a tremendous quantity of water passed down stream. In the winter time 200,000 cubic feet of water per second is the quantity of water which flows into the St. Lawrence. In fifty days 864,000,000,000 cubic feet of water passed the point where 6,000 cubic feet of ice was formed, showing that 144 million times more water passed down stream than was turned into ice.

In conclusion Mr. Murphy said that as the people of the Province of New Brunswick were at present interested in hydro-electric development he would advise them to be careful in establishing their power plants, and consider the minimum as well as the maximum flow of the stream.

Mr. Murphy answered several questions from those present regarding points raised in his address.

A vote of thanks for the instructive address was moved by F. B. Fripp, A.M.E.I.C., seconded by J. D. McBeath, M.E.I.C. A vote of thanks was moved by H. J. Crudge, A.M.E.I.C., seconded by R. G. Gage, M.E.I.C., to H. F. Finnimore who operated the moving picture machine so efficiently.

This meeting had been open to the public and although there were quite a few counter attractions a number of outsiders attended and all those present were delighted to have had an opportunity of hearing Mr. Murphy's address which was both interesting and instructive, the pictures shown were well worth seeing as they depicted so clearly the various conditions dealt with by the Speaker.

Some Features of Locomotive Design

The regular monthly meeting was held in the City Hall on Thursday evening, February 10th, and a large number of members attended.

Frank Williams, A.M.E.I.C., of the Mechanical Department, read a most instructive and interesting paper entitled "Some Features of the Design of Locomotives Introduced for the Purpose of Modifying their Effect on the Track".

After the reading of the paper a general discussion was entered into by members present, and many practical problems arising in locomotive operation were discussed.

F. O. Condon, A.M.E.I.C., moved a vote of thanks to Mr. Williams, which was seconded by Mr. W. E. Barnes, general master mechanic, Canadian National Railways.

February, this year, marked an important period in the history of the Moncton Branch, when several members attended the Professional and Annual Meeting of *The Institute* held on Feby. 1st, 2nd and 3rd, at the King Edward Hotel, Toronto. Those who attended were W. A. Duff, Chairman of the Moncton Branch, Messrs. S. B. Wass, F. B. Fripp, F. B. Tapley and E. R. Evans.

The meeting was thoroughly enjoyed and each member was impressed by the activities of *The Institute*, and regrets that more of the members were not privileged to attend; as such meetings cultivate a fraternal spirit which will be beneficial to the profession.

Much praise is due the members of the Entertainment Committee and to the Toronto Branch for the excellent entertainment provided, for which the visiting members of the Moncton Branch wish to express their appreciation.

REPORT OF COUNCIL MEETING

At the regular meeting of Council held on February 22nd, the Standing Committees of the Council were appointed, and other committee matters dealt with as follows:

Finance Committee:—R. A. Ross, Chairman, H. H. Vaughan, Sir Alexander Bertram, Lesslie R. Thomson, K. B. Thornton.

Library and House Committee: Sir Alexander Bertram, Chairman, R. de L. French, S. F. Rutherford, J. Colin Kemp, F. P. Shearwood.

Publications Committee:—H. H. Vaughan, Chairman, Balance of Committee to be nominated by Mr. Vaughan.

Legislation and By-laws Committee:—The suggestion of the Special Committee, that the Legislation Committee include also the work of the former By-laws Committee, the Committee to be known as Legislation and By-laws Committee, under the Chairmanship of Walter J. Francis, two to be nominated by him to complete his Committee. It was resolved that this Committee should have a corresponding member in each Province, in connection with Legislation and should keep in touch with each Branch for suggestions regarding changes in the By-laws.

Papers Committee:—Frederick B. Brown, Chairman, C. E. W. Dodwell, G. G. Murdoch, W. A. Duff, A. R. Decary, Arthur Surveyer, C. P. Edwards, R. H. Parsons, J. M. Campbell, R. O. Wynne-Roberts, H. U. Hart, W. P. Near, A. J. Riddell, L. L. Jacobs, W. M. Scott, A. R. Greig, D. S. Carter, P. Turner Bone, Geo. A. Walkem, E. G. Marriott, C. M. Odell.

Gzowski Medal and Students' Prize:—H. H. Vaughan, Chairman. Committee to be nominated by Chairman.

Leonard Medal Committee:—H. E. T. Haultain Chairman. Committee to be nominated by Chairman.

Plummer Medal Committee:—H. E. T. Haultain, Chairman. Committee to be nominated by Chairman.

Steam Boilers Committee:—L. M. Arkley, Chairman, W. G. Chace, F. G. Clark, R. J. Durley, D. W. Robb, H. H. Vaughan.

Board of Examiners and Education Committee:—H. M. Mackay, Chairman, Arthur Surveyer, Secretary, Ernest Brown, J. M. Robertson, R. de L. French, R. S. Lea, A. R. Roberts.

Canadian National Committee of the International Electrotechnical Commission:—L. A. Herdt, Chairman, L. W. Gill, O. Higman, J. Kynoch, T. R. Rosebrugh, John Murphy, A. B. Lambe, J. A. Dupre.

International Co-operation Committee : — H. H. Vaughan, Chairman, John Murphy, W. F. Tye.

Roads and Pavements Committee:—W. A. McLean, Chairman. Balance of Committee to be nominated by Chairman.

Canadian Engineering Standards Committee—:Walter J. Francis, three years; H. H. Vaughan, two years; W. F. Tye, one year.

Policy Committee:—J. B. Challies, Chairman, A. R Decary, Brig.-Gen. C. H. Mitchell, Walter J. Francis K. H. Smith, J. G. Sullivan, A. E. Foreman, F. H. Peters.

Civil Service Classification Committee:—J. M. R. Fairbairn, Chairman, R. A. Ross, Lt.-Col. R. W. Leonard, W. F. Tye, H. H. Vaughan, G. Gordon Gale, Arthur Surveyer.

Concrete Deterioration in Alkali Soils Committee:—C. J. MacKenzie, Chairman. Suggested Committee not confirmed.

Honour Roll Committee:—Brig.-Gen. C. J. Armstrong, Chairman, Col. A. E. Dubuc, Fraser S. Keith.

Classification and Remuneration Committee:—A. H. Harkness, Chairman, E. R. Gray, Frederick B. Brown, A. R. Decary, J. B. Challies.

Publicity Committee:—Frederick B. Brown, Chairman, H. H. Vaughan, J. B. Challies, P. Gillespie.

A progress report was received from the Publicity Committee and also from the Committee on Policy, it being intended that these reports be considered at the next meeting of Council. The suggestions of the Ontario Provincial Division, included in the annual report, were referred to the Committee on Policy. No action was taken as to the suggestion that *The Institute* make representations to the Government urging the passing of the proposed Research Council Bill to establish a National Research Institute. Consideration was given to the work of *The Institute's* Committee on Concrete Deterioration in Alkali Soils. The hearty co-operation of the Council was assured the chairman in bringing this work to a successful conclusion. The status of surveyors in applying for admission was considered. It was decided that each applicant would be considered on his individual qualifications as heretofore, the question in the meantime to be submitted to the Committee on Legislation and By-laws. It was resolved after considerable discussion, in considering the question of meetings of Council in different districts, that Council considers it advisable that a plenary meeting of Council should be held at an early date, to which mileage of each member would be paid, it being suggested to the Finance Committee that a report of the cost be submitted to the next meeting. Exchange of courtesies between the Founder American Societies and *The Institute* was brought up and the situation noted, together with a price list of the publications of the American Society of Mechanical Engineers; the Secretary being instructed to place this information before the members. The suggestion that a handbook giving information regarding *The Institute*, was favourably considered. The Secretary was instructed to extend to the executive and members of the Canadian Institute of Mining and Metallurgy, the privileges of headquarters during their convention in March. A grant of two hundred dollars was voted to the Canadian Engineering Standards Association.

It was resolved as a result of a suggestion from the Western Branches that members be urged to make a point of getting in touch with the officers of other Branches when visiting Branch centres, and attend meetings when possible, as well as to be ready to address the Branch.

Approval was expressed of the continuation of the principle now in vogue, that each Branch should express its opinion of candidates for admission within its jurisdiction, but that a definite limit of thirty days be set for a reply unless a request for a further extension of time be desired. Approval was given to the suggestion that the Secretary stop at Kamloops on his Western trip with a view to organizing a Branch there. Approval was also given to the proposal of the Saskatchewan Branch to hold the Western Professional Meeting at Saskatoon under its auspices during the coming summer. Discussion regarding delinquents evolved the resolution that the letter of the By-laws, although giving Council discretionary powers, be more closely followed in future and that the attention of the Branch Executives be particularly directed to the delinquents as shown on rebate statements. The price of the nineteen hundred and twenty-one Year Book of *The Institute* was fixed at one dollar and fifty cents. Many other matters were discussed and various correspondence noted.

Eight Corporate Members of *The Institute* were reinstated and six resignations were accepted. Classifications were made for a ballot returnable in March. The following Students were admitted:—J. C. Angus, C. C. Ashcroft, A. G. Barrett, G. F. Binns, C. L. Breithaupt, C. L. Brooks, A. T. Byram, D. V. Canning, W. L. Churchill, G. M. Chute, C. F. Cockshutt, A. N. Conklin, E. Cowan, K. T. Cregeen, G. A. Day, W. R. Dunbar, F. R. Eckert, F. C. Eley, M. J. Evans, W. J. Evans, H. A. Fair, R. A. Fairbairn, H. F. Farncomb I. H. Forster, R. A. H. Galbraith, H. J. Goldberg, A. H. Greenwood, C. Hamilton, W. J. Harman, A. H. Heatley, R. W. Hendershot, F. S. Howes, Carl H. Jackson, Chas. H. Jackson, W. H. Keith, M. C. Kelly, W. M. Kennedy, W. E. Kenney, C. C. Langstroth, W. D. Lappin, R. G. H. McLeish, H. K. MacLean, A. M. Matheson, G. L. McGee, H. A. McKay, A. E. McNicoll, D. S. Mellett, E. K. Mueller, D. J. Munro, J. C. Nutter, R. L. Piper, R. V. Plewes, K. M. Ramsey, J. H. Reynolds, J. G. Robertson, N. E. Russell, W. M. Smith, H. N. Spence, L. B. Stirling, D. C. Summers, F. B. Thompson, J. W. Turner, L. M. Vardon, H. S. Weldon, L. A. G. Winter, T. H. Winter.

Preliminary Notice

of Applications for Admission and for Transfer

19th February, 1921

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in March, 1921.

FRASER S. KEITH, Secretary.

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*The professional requirement are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option Railway, Municipal, Hydraulic, Mechanical, Mining, or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-five years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits scientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

ABRAHAM—EDWARD FOSTER, of Sackville, N.B. Born at Halifax, N.S., Nov. 7th, 1899; Educ., Eng'g. Course, N.S. College Night School, 1917-18. At present taking bridge engr'g course, I.C.S.; 1916 to date, with engr'g. dept., C.N.R., as rodman, acting instr'man and at present asst. concrete inspector.

References: W. A. Duff, S. B. Wass, R. H. Smith, F. G. McPherson, R. J. Anderson, J. G. Dryden.

ACKERMAN—PAUL, of Montreal, Que. Born at Aarus, Switzerland, March 18th, 1881; Educ., Swiss Federal Polytechnical College Zurich, Switzerland; 1908-09, designing engr. for induction motors, Brown Boveri Co., Switzerland; 1910-11, asst. elect'l. engr., Pennsylvania Water & Power Co., Holtwood, Penn.; 1911 (June-Dec.), elect'l engr. on design, supervision etc., Mather Yuill & Co., Vancouver; 1912 (Jan.-Aug.), complete charge of design & supervision of constn. of electric wood distillation plant, Canadian Electric Turpentine Syndicate, Vancouver; 1912-14 & Nov. 1915 to 1918, elect'l engr. in full charge of the Relay Protective System, Toronto Power Co., Toronto; 1915 (Jan.-Sept.), survey of transmission and distribution system with regard to Relay Protection & service improvements in general, Riegos Y Fuerza Del Ebro, Barcelona, Spain; Nov. 1918 to date, elect'l engr., in full charge of development of Relay Protective system, and adviser on service improvements in general, Shawinigan Water & Power Co., Montreal.

References: J. C. Smith, J. Morse, S. Svenningson, F. T. Kaelin, P. S. Gregory, B. L. Silver.

ADAMS—WILLIAM C., of Montreal, Que. Born at Martin County, Minnesota, U.S.A., Sept. 10th, 1880; Educ., E.E., Minnesota Univ., 1901; During vacations, dftsman on patent office and mach drawings; 1905-06, equipment engr'g., Stromberg Carlson Telephone Mfg. Co., Rochester, N.Y.; 1906-19, with Western Electric Co., New York & Chicago as follows:—1906-08, telephone equipment engr'g., 1908-09, insp'r of apparatus manufactured in New York shops. 1909-13, engr'g insp'n. of complete telephone central office equipment. In charge of this work for 1½ years. 1913-14, in charge all engr'g inspection work at Hawthorne plant, Chicago. 1914-16, in charge of detail inspection of material, tools & apparatus purchased by company. 1916-17, in charge of above divn. of engr'g dept's work, including clerical & accounting work connected with it; April 1919 to date, chief engr., Northern Electric Co. Ltd., Montreal.

References: P. F. Sise, J. D. Hathaway, J. S. Cameron, N. L. Morgan, T. Eardley-Wilmot.

ALDER—JAFFRAY DACRE, of Montreal, Que. Born at Dumfries, Scotland, Nov. 29th, 1881; Educ., Dumfries Evening Technical School, 1898-1903. Rutherford College of Science, Newcastle-on-Tyne, 1904-05; 1898-1903, 5 yrs. ap'ticeship, Dumfries Iron Works, including 1 year in drawing office. Also 6 mos. dftsman with same firm; 1904-05, engine fitter, Wallsend Slipway & Engr'g Co., Newcastle-on-Tyne; 1905-12, with C.P.R. Ocean Steamship Service, as 7th to 3rd engr. on passenger liners. Passed British Board of Trade Exam. "Extra 1st class engr" in 1910; 1912 to date with Darling Bros. Ltd., Montreal, as 1912, dftsman, 1913-15, sales engr., 1916-18, supt. shell dept., and 1919 to date, plant supt.

References: J. T. Farmer, F. A. Combe, J. S. Cameron, N. C. Cameron, I. J. Tait, J. T. Steeves, W. N. Dietrich.

ALLAN—THOMAS ALEXANDER, of Montreal, Que. Born at Mid Caldor, Scotland. Dec. 26th, 1889; Educ., Allan Glen Tech. School, 2 years. Royal Glasgow Tech. College, Bldg. Constrn. (part time) 4 years, 5 years arch'l ap'tice, MacWhannell, Rogerson & Reid, Glasgow, 1913-14, signal dftsman, C.P.R.; 1914-1916, signal dftsman, 1916-18, signal insp'r., G.T.R.; 1917-19, chief signal insp'r., signal pilot, Industrial Commerce Comm'n., United States Valuation; At present chief signal insp'r., G.T.R., Montreal.

References: F. L. C. Bond, A. S. Going, W. McNab, A. Crumpton, M. S. Blairklock, W. Walter, K. R. McLennan.

ALLEN—CHARLES ALBERT, of Strathmore, Que. Born at Leytonstone, London, England, July 1st, 1886; Educ., London C. C. S. Exam. 1900 and Technical 1901. Montreal Technical Evening Classes, 1909-13; 1902-09, bldg. & constrn. erection; 1909-21, constrn. & engr'g.; 1913 to date, designing struct'l steel, reinforced concrete & domestic engr'g. for The Bell Telephone Co. of Canada, Central Office bldgs.

References: E. S. Mattice, F. F. Sise, J. D. Hathaway, E. G. M. Cape, A. F. Byers, G. M. Hudson.

ANDERSON—JAMES CULLAM, of Prince Rupert, B.C. Born at Solsgirth, Man., Jan. 5th, 1890; 1910-15, with G.T.R., 1912-13, rodman, 1913-15, instr'man, 1917-19, overseas, Lieut., Can. Rly. Troops, asst. ch. engr. and later engr. in charge, location & constrn. broad & narrow guage rlds. in France & Belguim; At present instr'man in charge of mtce of way party under W. H. Tobey, Prince Rupert.

References: J. A. Heaman, H. W. Tooker, W. S. Fetherstonhaugh, W. H Tobey, M. A. Burbank, F. R. Purvis.

ARMSTRONG—CHRISTOPHER GILLETTE RUSSELL, of Amherstburg, Ont. Born at Merlin, Ont., Oct. 8th, 1896; Educ., B.A.Sc., Univ. of Toronto, 1920; 1917 (5 mos.), with Canadian Copper Co., Creightom Mine, Ont., as dftsman & asst. on topog'l. & underground survey party; 1918 (5 mos.), dftsman & layout man, Southern Ontario Gas, Co., Glenwood, Ont.; 1919 (5 mos.), with J. J. Newman, C.E., O.L.S., Windsor, Ont., asst. to munic. engr. on county work; 1920 (Apr.-Aug.), with Owen McKay, C.E., O.L.S.; Sept. 1920 to date, asst. supt. on constrn., Brunner, Mond Canada Co., Ltd., Amhersburg, Ont.

References: P. Gillespie, J. J. Newman, L. T. Bray, C. R. McColl, O. Rolfson.

AULD—ROBERT WHYTE, of Calgary, Alta. Born at Strichen, Aberdeenshire, Scotland, Nov. 1st, 1887; Sharp's Institution, Scotland. Private tuition; 1903-08, 4 years ap'ticeship & 1 year asst. Condie Mackenzie & Co., Perth, Scotland; 1910-14, asst. to John Waldron, C.E., D.L.S.; 1914-19, overseas, Lieut., Royal Engrs. & Artillery; 1920, instr'man & classifier, and at present junior engr., irrig. divn., Dept. of the Interior, Calgary.

References: F. H. Peters, M. H. Marshall, V. M. Meck, A, Smith.

BALL—WALTER LANCE, of Moncton, N.B. Born at Truro, England, Aug. 15th, 1888; Educ., Course in private engr'g school, England. Member, Assn. of Prof. Engrs. of the Province of N.B.; 1906-08, rodman, C.P.R.; 1908-09, transitman on D.L.S. under Harrison & Ponton, M.E. & D L.S., Calgary, Alta.; 1909-10, transitman, G.T.P.; 1910-11, res. engr. in charge of bridges, G.T.P.; 1911-12, res. engr. in charge of township sub-division, Harrison & Ponton, Calgary; 1912-14, instr'man in charge of field work, rld. constrn., C.P.R.; 1915-16, dftsman on rly. location party; 1916 to date, instr'man, mtce of way, C.N.R.

References: H. W. B. Swabey, H. Phillips, W. R. Devenish, R. H. Emmerson, J. S. O'Dwyer, G. M. Ponton, S. B. Wass.

BANIGAN—JOSEPH, of Toronto, Ont. Born at Blackstone, Mass., U.S.A., June 20th, 1888; Educ., B.A.Sc., Univ. of Toronto, 1917; 1917-1919-1920. designing and supervising erection of industrial bldgs., as member of firm Banigan, Armstrong & Thompson, Architects & Engrs.; 1918, vice-pres. & treas. in charge of constrn., Commercial Solvents Corp., Terre Haute, Indiana. Company jointly owned by U.S. & British Govts.; At present member of firm, Banigan, Armstrong & Thompson & Griffenhagen & Associates.

References: C. H. Mitchell, T. R. Loudon, C. S. L. Hertzberg, G. T. Clark, C. R. Young, W. P. Dobson, P. Gillespie, H. G. Acres.

BARR—SHIRLEY, of Montreal, Que. Born at Mechanicsburg, Ohio, U.S.A., Oct. 12th, 1878; 1902-03, Harris Press Co.; 1903 (Mar.-July), dftsman & tracer, Oliver Typewriter Co.; 1903-06, dftsman on steam power plant and rly. shop design & constrn., The Arnold Co., Chicago, Ill.; 1906-07, dftsman, Western Canada Cement & Coal Co.; 1907-09, in charge of dfting & detailing for addition to Hull plant of International Portland Cement Co.; 1909 to date, with Canada Cement Co. as chief dftsman and at present chief engineer.

References: A. C. Tagge, H. S. Van Scoyoc, F. A. Ritchie, J. W. Seens, D. C. Tennant.

BARRITT—NELSON, of Winnipeg, Man. Born at West Pittston, Pa., U.S.A., Oct. 28th, 1882; Educ., 2 yr. course Pa. State College. 1 year Cornell Univ.; 1906, dftsman, North Coast R.R.; 1907, transitman, North Coast R.R. & Penhandle R.R.; 1908, engr. for Midas Mining Co.; 1908, charge of party, U.S. Govt. Land Survey; 1909-10, transitman, Milwaukee R.R.; 1910-11, transitman, San Pedro, Los Angeles & Salt Lake R.R.; 1911-12, transitman, Can. Northern R.R., 1912-14, gen. work, Man. Govt., in charge of drainage district No. 16; 1915, gen. work, Man. Govt.; 1916 to date, dist. engr., reclamation dept., Man. Govt.

References: H. A. Bowman, D. L. McLean, A. H. Corbett, G. Affleck, R. W. McKinnon.

BARTLEY—THOMAS HOLMES, of Ottawa, Ont. Born at Toronto, April 21st, 1889; Educ., B.A.Sc., Univ. of Toronto, 1920; 1911. on constrn. of branch line of T. & N. O. Rly., part of time in charge under divn. engr.; 1912-14, private practice in Toronto, mostly Ontario Land Surveying, also field investigations in Northern Ontario for British America Nickel Co.; 1915-19, with Topog'l Surveys Branch, Ottawa, as Comm'n'd D.L.S., also certain amount of private practice, 1919 to date, asst. controller of surveys, Topog'l Surveys Branch, Ottawa.

References: G. B. Dodge, S. B. Clement, F. W. Thorold, C. H. Herriot, P. E. Palmer, A. d'O. d'Orsonnens.

BARTON—HAROLD MIALL, of Ottawa, Ont. Born at Maldon, Surrey, England, Aug. 30th, 1883; Educ., Crystal Palace School of Practical Engr'g., 1904. D.L.S., 1912, 1904-07, asst. engr., Natal Harbour Works, Durban, Natal, South Africa; 1908-11, with Geodetic Survey of Canada as recorder with precise levelling party, and asst. to D.L.S.; 1912, in charge of triangulation in the field, under J. J. McArthur, D.L.S., on International Boundary Surveys; At present Geodetic Engr., International Boundry Surveys, Dept. of the Interior.

References: J. J. McArthur, J. D. Craig, W. A. Bowden, P. B. Motley, W. M. Tobey, J. L. Rannie, F. B. Reid.

BELL—RICHARD THOMAS, of Toronto, Ont. Born at Glasgow, Scotland, Jan. 17th, 1884; Educ., St. John's College, Loughton, England; 1901-04, leveller & transitman, T. & N. O. Ry.; 1904-07, res. engr., T. & N. O. Ry.; 1908-10, res. engr., N.T.C. Ry.; 1910-12, divn. engr., N.T.C. Ry.; 1912-14, contracting engr. on concrete bridges etc., 1914-16, supt. of constrn., Toronto-Hamilton Highway; 1916-19, overseas Capt., Can. Rly. Troops; At present, engineer, traffic dept., Toronto Transportation Commission.

References: E. T. Agate, H. L. Bucke, W. S. Fetherstonbaugh, W. G. Hewson, K. Weatherbe, W. P. Wilgar, W. B. Russel, A. McLellan, D. MacPherson, T. S. Armstrong, F. H. Emra, C. Grant, E. A. James, G. A. McCarthy, E. W. Reed-Lewis, A. Stephen, F. H. Kortright.

BERKELEY—GARNET LAWRENCE, of Toronto, Ont. Born at Belleville, Ont., May 4th, 1890; Educ., Grad. S.P.S. Univ. of Toronto, 1911; O L.S.; 1907-08, surveying with J. Shaw, O.L.S., North Bay, Ont.; 1911-12, leveller and transitman, railway, bridge & docks dept., City Hall, Toronto; 1912-16, asst. engr., in surveys and land dept., in charge of field parties, Toronto Harbour Commission; 1916-18, overseas, Capt. & O. C., 4th Divisional Cyclist Corps; 1918 to date, asst. land engr., Toronto Harbour Commission.

References: E. L. Cousins, J. G. R. Wainwright, N. D. Wilson, G. T. Clark, H. A. Goldman, I. F. Willsie, H. P. Heywood.

BERRY—ALBERT EDWARD, of Toronto, Ont. Born at St. Mary's, Ont., Oct. 6th, 1894; Educ., B.A.Sc., Univ. of Toronto. 1917, 1915 (3 mos.), asst. to town engr., Dunnville, Ont.; 1916 (4 mos.). foreman. bridge constrn.; 1917 (Apr.-May), with E. A. James Co. Toronto; 1917 (June-Nov.), asst. engr.. Experimental Station of the Ontario Prov. Board of Health; 1918, overseas, officer, Royal Engrs.; Sept. 1919 to date, asst. sanitary engr., Ontario Prov. Board of Health.

References: F. A. Dallyn, S. Shupe P. Gillespie, C. R. Young, E. M. Proctor.

BEVAN—WILLIAM HARRY BASIL, of Toronto, Ont. Born at Harriston, Ont., Oct. 13th, 1883; Educ., S.P.S., Univ. of Toronto, 1902-04; 1903 (summer), testing cement & rodman, Canadian Niagara Power Co., Niagara Falls, Ont.; 1904-06, rodman & instr'man, C.N.R.; 1907, mtce work & grade reduction, G.T.R., London, Ont.; 1908-10, res. engr. on constrn. C.N.R.; 1910-11, contracting; 1911-13, res. engr. on constrn. C.N.R.; 1913-14, contracting, 1914 (Mar.-Aug.), constrn. engr., Union National Gas Co., Chatham, Ont.; 1914-19, overseas, Can. Engrs.; 1919 (Apr.-Oct.), divn. engr., C.N.R.; 1919 to date, asst. dist. engr., C.N.R., Toronto.

References: A. F. Stewart, H. T. Hazen, D. O. Lewis, G. P. MacLaren, H. G. Acres, J. R. Mackenzie, H. K. Wicksteed.

BLACK—ALBERT REGINALD, of Toronto, Ont. Born at Dublin, Ireland, Nov. 16th, 1892; Educ , Morgans College, Castleknock, Co. Dublin, Ireland; 3½ yrs. with J. H. Ryan, M.I.C.E., Dublin, land surveying, railroad, hbr. and dock constrn.; 1906-10, with J. H. Ryan, M.I.C.E.; 1914-18, overseas, 13th Bn., R.H.C.; 1918 (July-Nov.), engr'g dept., Canadian Areoplanes Ltd.; 1919-20. instructor in dftsmanship, D.S.C.R.; May 1920 to date, with Barber, Wynne-Roberts & Seymour, Consltg. Engrs., Toronto.

References: F. Barber, R. O. Wynne-Roberts, G. R. Jack, H. L. Seymour, J. G. Jack.

BLAIKLOCK—HENRY MUSGRAVE, of Montreal, Que. Born at Montreal, Aug. 13th, 1899; 1916-20, gen. engr'g., dfting, designing, etc., under K. R. McLennan, office engr., G.T.R. Montreal; 1920 (Mar.-Oct.), instr'man under J. P. Menard, asst. engr., G.T.R., Montreal; Oct. 1920 to date, senior instr'man, divn. engr's office, Eastern Lines, G.T.R.

References: W. Walker, J. P. Menard, K. R. McLennan, A. S. Going, M. S. Blaiklock, H. H. Luscombe, G. M. Stewart, E. Nicholson.

BLAIR—JAMES FAGER, of Toronto, Ont. Born at Orillia, Ont., March 31st, 1888; Educ., School of Science, Univ. of Toronto, 1906-10; 1906-07 (summers), mach. shop, Spanish River Pulp & Paper Co.; 1909-10 (summers), dftsman, mining recorders office Gowganda, Elk Lake & Toronto; 1910-12, designing dept., Smith, Kerry & Chace, designing and estimating power Houses etc.; 1913-16 designer, Toronto Harbour Commission; 1916-19, overseas, Lieut., 198th Bn., Can. Forestry Corps & Engrs.; 1919-20, insp'r of constrn., Toronto Harbour Comm'n.; April 1920 to date, designing engr. & chief insp'r Toronto Harbour Commission.

References: G. T. Clark, J. G. R. Wainwright, H. A. Goldman, H. P. Heywood, E. L. Cousins, F. M. Byam, W. Cross.

BLINCO—TROY EUGENE, of Grand Mere, Que. Born at Raton, New Mexico, Nov. 9th, 1895; Educ., McGill Matric., 1914; I.C.S. course in civil & mech. engr'g.; 1912-13 (summers), rodman on constrn., Laurentide Paper Co., Grand Mere, Que.; 1914-17, dftsman, rodman & instr'man with above company; 1917-19, overseas, Can. Engrs., & R.A.F.; 1919-20, dftsman and instr'man, and from Jan. 1920 to date, asst. field engr., Laurentide Paper Co., Grand Mere.

References: H. O. Keay, J. J. O'Sullivan, H. E. Bates, C. R. McCort, E. A. Ryan.

BORDEN—PERRY ARCHIBALD, of Toronto, Ont. Born at Pugwash, N.S., July 2nd, 1887; Educ., B.Sc. (E.E. with Honours), Queen's Univ., 1911. Teacher of elect'l subjects in night classes, Toronto Technical High School since 1913. Member, Amer. Inst. Elect'l Engrs. At present Secretary, Toronto Section; 1903-05, ap'tice machinist, Robb Engr'g Co., Amherst; 1906, 3 mos. asst. elect'n., Allis Chalmers Bullock, Montreal & 2 mos. shift engr in power plant, Rhodes Curry & Co., Amherst; 1910-11, asst. to engr. in charge of metering devices, Ontario Power Co., Niagara Falls; 1912 to date, engr. in charge of elect'l meters & standards, H.E.P.C. Laboratories, Toronto.

References: E. B. Merrill, R. B. Young, W. P. Dobson, D. M. Fraser, W. D. Walcott, L. W. Gill, E. T. J. Brandon.

BRIDGES—ERNEST TURNER, of Toronto, Ont. Born at Norton, Suffolk, England, May 1st, 1888; Educ., Framlingham College, England, 1904. Evening Classes in mach. design, applied mechanics, steam & heat engines, Ipswich, England, 1905-10; 1904-07, 3 yrs. ap'ticeship with Cocksedge & Co., Ipswich, England; 1907-10, dfting dept., Cocksedge & Co., on design of mech. engr'g & struct'l steel work, including mill & factory bldgs. & bridge constrn.; 1911-12, dftsman & checker, Oliver Chilled Plow Works, Hamilton, Ont.; 1912-15, checker, McGregor & McIntyre, Toronto; 1915-19, ch. dftsman with above firm, on struct'l steel, bridge work etc., and from 1919 to date, ch. engr. for same firm.

References: F. M. Byam, C. B. Hamilton, Jr., A. R. Robertson, E. M. Proctor, W. K. Scott.

BROPHY—GEORGE PATRICK, of Ottawa, Ont. Born at Ottawa, Sept. 22nd, 1887; Educ., 3 years Applied Science, McGill Univ.; 1909-10 (summer), hydrographer under C. Chaloner, precise levelling party, P.W.D. Canada; 1911, instr'man and asst. engr. under F. S. Lazier, res. engr., Campbellford, Ont., Trent Canal constrn., 1913-14. dftsman under C. R. Coutlee, Ottawa River Storage, P.W.D. Canada; 1915, asst. to res. engr., P.W.D. Fort Francis, Ont., Part time in full charge; 1915-16, asst. engr. on constrn., Big Chaudiere Dam, French River, Ont.; 1917, asst. engr., under S. J. Chapleau, dist. engr., Upper St. Lawrence River; 1918 to date, asst. to S. B. Johnson, hydrometric engr., Ottawa River Storage, P.W.D. Canada.

References: C. R. Coutlee, S. J. Chapleau, S. B. Johnson, E. D Lafleur, C. Chaloner, A. DesRosiers, A. J. Matheson, M. Murphy, A. Gray.

BURWASH—NATHANAEL ALFRED, of Toronto, Ont. Born at Cobourg, Ont., Sept. 28th, 1870; Educ., B.A.Sc., Univ. of Toronto, 1905, 1903-04, ap'tice to Speight & Van Nostrand, O. L. Surveyors, Toronto; 1905-06, dftsman, leveller & transitman, N.T.C. Rly.; 1907-10, private practice D.L.S., Whitehouse, Y.T., survey of mining claims; 1911-14, with Speight & Van Nostrand on city & govt. surveys; 1917-20, dftsman & O.L.S., Dept. of Public Highways, Ontario; At present O.L.S., Dept. of Public Highways, Toronto, Ont.

References: W. A. MacLean, G. Hogarth, P. Gillespie, C. R. Young, H. W. D. Armstrong, A. L. MacLennan.

CAIRNS—HARRY LISTER, of Shaunavon, Sask. Born at Jedburgh, Scotland, July 31st, 1887; Educ., Dundee Technical Institute & Heriot Watt College, Edinburgh; 1903-07, ap'ticed to Charles Mann, C.E., Dundee; 1908-09, asst. with City of Edinburgh engr's dept.; 1910-12, topog'r & dftsman on C.P.R. location; 1912-14, dftsman & instr'man, C.P.R. constrn.; 1915-19, overseas, Comm'n'd Royal Engr. Served in France & Russia. Also instructor in mil. engr'g., Newark Training Centre during 1918; July 1920 to date, instr'man, C.P.R. constrn.

References: W. A. James, J. G. Reid, T. C. Macnabb, T. C. Main, R. O. Wynne-Roberts, C. E. Joslyn.

CHAPPELLE—JOSEPH WALTER SANDS, of Edmonton, Alta. Born at St. John, N.B., Jan. 24th, 1884; Educ., Mining Engr'g., Queen's University, 1903; 1903, rodman on constrn., Portland & Rumford Falls Ry., Maine, U.S.A.; 1904, leveller on location, International Rly. of N.B.; 1904-05, leveller, location surveys, T.C.Ry., Fredericton, N.B.; 1905-07, leveller, dftsman, transitman and acting engr., in charge Transcontinental Ry. Surveys in Districts D & F, St. Boniface, Man.; 1907-09, res. engr., with above rly.; 1909-10, engr'g partner, Cameron-Chappelle Ltd., Contractors, T.C.R., Nipigon, Ont.; 1911-13, asst. engr., in charge of constrn., C.N.R. Main line, Entwistle, Alta.; 1913-16, constrn. engr. and contractor for rlys and govt., including grading, concrete and bridge constrn.; 1917-18, insp'g valuation engr. of 985 miles C.N. & G.T.R., Alberta lines and terminals for "The Comm'n of Inquiry into Rlys. & Transportation"; 1918-19, valuation and costs in constrn. of coke & by-products plant for Granby Consolidated Mining & Smelting Co. Ltd., Anyox, B.C.; 1920 to date, asst. engr., C.N.R., Edmonton.

References: C. S. Gzowski, Jr., W. P. Wilgar, G. Grant, G. F. Richan, E. R. Millidge, A. W. Haddow, A. M. Macgillivray, T. W. White, J. V. Dillabough, E. K. Hall, J. A. Moody.

COCKBURN—ALBERT EDWARD, of Niagara Falls, Ont. Born at Kingston, Ont., March 11th, 1897; 4 years overseas, 38th Bn., 7 mos. with H.E.P.C. of Ontario on constrn. at Niagara Falls, and at present junior dftsman.

References: G. H. Lowry, F. W. Clark, A. C. D. Blanchard, N. Malloch.

COOPER—ASHTON BURTON, of Toronto, Ont. Born at Bloomfield, Ont., Dec. 31st, 1883; Educ., B.S. (E.E.), Tufts Univ., 1903; 1903-05, testing dept., General Electric Co., Schenectady, N.Y.; 1905-07, Westinghouse Co., Pittsburg, as res. engr. for Dr. F. S. Pearson; 1907-09, asst. elec. engr., in charge power house elect'l constrn., Rio de Janeiro Tramway Light & Power, Brazil; 1909-13, engr., Transformer Sales Dept., Gen. Elec. Co., Schenectady, N.Y.; 1913-21, transformer engr., Canadian General Electric Co. Ltd., Toronto. In charge of general design and sales policy for power transformers.

References: W. A. Bucke, W. P. Dobson, E. T. J. Brandon, P. E. Hart, W. Maclachlan, D. M. Fraser.

COWAN—WILLIAM RAE, of Toronto, Ont. Born at Hamilton, Scotland, June 15th, 1898; 1st year student, Applied Science, Univ. of Toronto; 1914-16, asst. to res. engr. on constrn. of mech. filtration plant on Toronto Island for City of Toronto; 1917 (July-Dec.), res. engr. on constrn. mech. filtration plant, Town of Oshawa, Ont.; 1918 (Jan.-Nov.), insp'r on aeroplane engine manufacture, Imperial Munitions Board; 1919 (May-Oct.), instr'man, Toronto Harbour Comm'n.; 1920 (July-Oct.), dftsman, National Iron Corpn., Toronto.

References: W. Gore, W. Storrie, T. R. Loudon, P. J. Duff, G. T. Clark, P. Gillespie.

CUMBERFORD—JAMES, of Amherst, N.S. Born at Wishaw, Scotland, July 12th, 1876; Educ., Technical classes (evenings). 1st class Colliery Mgr's Cert., 1902; 5 years underground mgr. in Scotland; 5 years asst. mining engr. & 7 years chief mining engr. at Minas Schwager, Coronel, Chile; Intends taking up consltg. work, specializing in coal, thin seams, coal cutting & conveying.

References: D. W. Robb, A. G. Robb, G. E. Newill, I. P. MacNab, J. H. Winfield.

CUMMINGS—JOHN, of Kelowna, N.C. Born at Roshbury, North'd, England, Jan. 6th, 1885; Educ., Engr'g Lectures, Edinburgh Univ., 1901-04. Assoc. Member Inst. C.E., London, England (by exam.), 1908; 1904-07, 3 yrs articled pupil to C. F. Murphy, A.M.I.C.E.; 1907, asst. engr. on staff of Sir James Mansorgh, on constrn. of Tynemouth Waterworks; 1909, leveller, C.N.R. survey party in Sask.; 1 year, asst. engr. Federated Malay States Rly. Resigned owing to ill health; Returned to Canada. Worked as instr'man, C.N.R. & C.P.R.; 1914-16, asst. engr. under Chinese Govt. on constrn. of Canton Hankow Rly. Design & constrn. of concrete structures, bridge piers, arches, etc.; 1916-18, overseas, Lieut., Can. Engrs., Discharged Dec. 1918 medically unfit. Since then under treatment and at present not employed.

References: C. N. Mitchell, Jr., T. W. Clarke, N. Wilson, F. J. Delaute, F. W. Groves.

CUSHING—WILLIAM WHELAN, of Hamilton, Ont. Born at Baltimore, Md., U.S.A., July 20th, 1881; Educ., Baltimore Polytechnic Institute, 1900 Engr'g lectures, Cornell Univ.; Dfting & surveying during holidays, Ch. dftsman & designer of bridges reinforced bldgs. etc., for The Roberts & Abbott Co., Consltg. Engrs., Cleveland, Ohio, on constrn. of the Washington, Baltimore & Annapolis Electric Rly.; 1906-09, principal asst. engr., on above work and finally mgr. of the Baltimore office of The Roberts & Abbott Co.; 1910-16, asst. ch. dftsman, The Hamilton Bridge Works Co. Ltd., including the design of special machinery for movable bridges; 1917-19, overseas, Can. Engrs.; 1919 to date, asst. to the ch. dftsman, and in charge of bridge dept., The Hamilton Bridge Works Co. Ltd., dfting dept.

References: R. K. Palmer, J. A. McFarlane, C. H. Marrs, E. H. Darling, W. G. Milne.

DAVIES—VERNON RUSSELL, of Three Rivers, Que. Born at Sheffield, England, Feb. 27th, 1890; Educ., B.Sc., McGill Univ., 1920; Summers 1913 & 14, rodman & instr'man, Lake of the Woods Watershed Survey; 1915 (summer), observer, triangulation, Maine—New Brunswick Bdy.; 1920 to date, junior asst., St. Maurice Lumber Co., Three Rivers, on constrn. of pulp & paper mill.

References: E. E. Brydone-Jack, E. Brown, H. M. MacKay, J. L. Rannie, T. M. Montague, J. W. Dorsey.

DELAPORTE—ANTOINE VALENTINE, of Toronto, Ont. Born at Toronto, July 24th, 1889; Educ., B.A.Sc., Univ. of Toronto, 1910; Fellowship at Univ. of Toronto; Research work at Experimental Station of Prov. Board of Health of Ontario, and from 1913 to date in charge of same.

References: F. A. Dallyn, P. Gillespie, H. E. T. Haultain, G. H. Ferguson, R. O. Wynne-Roberts.

DENNIS—EARLE MUNRO, of Ottawa, Ont. Born at Holbrook, Ont., Jan. 26th, 1883; Educ., B.Sc., Queen's Univ., 1904. D.L.S., 1908; 1904-12 (with exceptions noted below), in office of the Surveyor General, Ottawa; Dec. 1905-Apr. 1906, asst. to R. W. Cantley, D.L.S., surveying in Alta.; 1907 (May-Dec.), asst. to E. W. Hubbell, D.L.S., on insp. surveys & resurveys in Sask.; 1912 to date, asst. chief of a divn. in the topog'l survey branch, Dept. of the Interior, Ottawa.

References: G. H. Herriot, P. E. Palmer, E. F. Browne, G. C. Cowper, W. C. Way.

DIXON—LEON—SNELL, of Mattawa, Ont. Born at Medford Center, Me., U.S.A., June 13th, 1886; Educ., B.S. (M.E.), Maine University, 1908; 1909-10, misc. bldg. constrn., as material man or engr. ,for different firms; 1911-12, insp'r & chief of party, Cape Cod Constrn. Co., Buzzards Bay, Mass., canal constrn., etc., 1912, transitman for H. S. Ferguson, New York City, topog'l surveys; 1912-13, transitman, topog'l surveys, Great Northern Paper Co., Bangor, Me.; 1913, bldg. dftsman, General Electric Co., bldg. dept., West Lynn, Mass.; 1913-15, engr'g dftsman, Eastern Mfg. Co., Bangor, Me., design & constrn., paper, pulp & saw mills; 1915-17, chief dftsman, & 1917-18, asst. mech. supt. with above firm; 1918 (Mar.-June), supervising engr., constrn. divn., U.S. Army, Jeffersonville, Indiana; 1918 (June-Dec.), production engr., mech. dept., constrn & Mtce., & Dec. 1918 to Mar. 1920, chief dftsman, design and constrn., Eastern Mfg. Co., Bangor, Me.; March 1920 to date, prin. asst. engr., Riorden Co. Ltd., Mattawa, Ont.

References: G. L. Freeman, S. Wang, A. K. Grimmer, B. H. Cripps, F. O. White, J. E. Pringle, J. A, E. Beauchemin.

DRAPER—GEORGE COLLIER, of Montreal, Que. Born at Toronto, Ont., Dec. 22nd, 1890; Educ., B.Sc., McGill Univ., 1914; 1911-12-13 (summers) dftsman, Dominion Bridge Co.; 1914-15, dftsman, St. Lawrence Bridge Co., Ltd.; 1915 (May-July), asst. engr. and later engr. in charge of constrn. of T.N.T. Plant, Canadian Explosives Ltd., Beloeil; 1916 (June-Sept.), asst. mech. supt., and to July 1917, res. engr., with above at Nobel, Ont.; 1917-19, overseas, R.F.C.; 1919 (May-Dec.), engr. in charge of power testing, Canadian Explosives Ltd., Beloeil; Dec. 1919 to date, res. engr. with above at Brownsburg, Que.

References: H. M. MacKay, E. Brown, D. C. Tennant, E. C. Kerrigan, A. B. McEwen, R. A. Ross, J. C. Day.

DUNNE—HUGH JOSEPH, of Ottawa, Ont. Born at Ottawa, Oct. 11th, 1881; Educ., Senior Matric. and special course in math. and surveying; 1904, computer, dftsman, etc., Geodetic Levelling Staff, P.W.D., Ottawa; 1907, first asst., Geodetic Levelling Staff and continuously engaged in this work to date. In 1914 had charge of same.

References: E. D. Lafleur, C. Chaloner, A. St. Laurent, S. J. Chapleau, C. R. Coutlee, A. J. Grant.

EDWARDS—NORMAN ISAAC EVANS, of St. Lambert, Que. Born at London, England, Dec. 1st, 1891; Educ., The Polytechnic Regent St., London, England, 1904-09; 1909-12, ap'tice with Yarrow & Co., Engrs. & Shipbldrs., Glasgow; 1913, dftsman, American Locomotive Co., Montreal; 1913-15 ,dftsman on design of frogs & switches, C.P.R.; 1915-20, engr. with Royal Navy; At present, dftsman on design of frogs & switches etc., C.P.R.

References: J. M. Fairbairn, J. W. Orrock, J. E. Armstrong, P. B. Motley, A. R. Ketterson, W. J. McAllister.

ELLIS—JOHN ATTWILL, of Moncton, N.B. Born at Arbroath, Scotland, Oct. 15th, 1882; Educ., Associate, City & Guilds Central Technical College, London, England, 1902; 1903-04, pupil, Great Northern Piccadilly & Brompton (Tube) Rly., London; 1904-05, pupil asst., surveying staff, Great Northern Ry., London, England; 1905 (May-Sept.), asst., signal engr's staff, G.N.R., London; 1905-10, sub. dist. officer, mtce & constrn., Oudh & Rohilkhand Rly., India; 1911-12, leveller, C.N.R.; 1912 (Apr.-June), transitman, location, C.P.R.; 1912-15, res. engr., constrn., C.P.R.; 1915-18, asst. engr. constrn., Can. Govt. Rlys.; 1918 to date, office engr., C.N.R., Moncton.

References: C. B. Brown, A. F. Stewart, W. A. Duff, F. B. Tapley, D. Hillman

ENGEL—NATHAN LOUIS, of Montreal, Que. Born at Montreal, Nov. 23rd, 1883; Educ., B.Sc., McGill Univ., 1907; 1904-05 (summers), electrical install'ns with Sayer Electric Co. & Garth Co.; 1906 (summer), switchboard operation & motor testing C.P.R. Angus Shops; 1907-08, designing tel. switchichboards, Northern Electric Co.; 1908-12, asst. to chief engr., Saraguay Electric & Water Co. In 1911 with consltg. engr., designed and supervised the elect'l install'n at Bordeaux Jail, Montreal; 1912 to date with Montreal Public Service Corpn. as follows:; 1912-18, in charge of the elect'l distribution system and water works system, and from 1918 to date, as above and assumed charge of the company's new business dept.

References: K. B. Thornton, J. M. Robertson, T. W. Lesage, L. A. Herdt, R. A. Ross, F. C. Laberge, G. R. MacLeod, J. E. Blanchard.

FARNSWORTH—RAYMOND, H., of East Angus, Que. Born at Elandera, Que., Sept. 13th, 1893; Educ., B.Sc., Queen's Univ., 1916. Post graduate work, London University, 1919; 1913 (summer), constrn. work Kingston Locomotive Works, and D.L.S. work in Northern Ontario; 1914-19, overseas, Can. Engrs.; Nov. 1919 to date, engr'g office, Brompton Pulp & Paper Co., East Angus, Que., on constrn design & detail, and gen. mill mtce.

References: F. O. White, J. A. Dickson, J. O'Neill, W. P. Wilgar, A. Macphail, W. L. Malcolm.

FINNEMORE—HAROLD FORSYTH, of Moncton, N.B. Born at Chicago, Ill., March 18th, 1893; Educ., B.Sc., Queen's Univ., 1917; March 1918 to date, dftsman., C.N.R., Moncton.

References: R. G. Gage, S. B. Wass, F. B. Fripp, H. J. Crudge, W. A. Duff, M. J. Murphy.

FLEMING—ROBERT, of Toronto, Ont. Born at Broughty Ferry, Scotland, March 29th, 1883; Educ., Fettes College, Edinburgh; 1 year architecture and 4 yrs pupilage with James Barron, M.I.C.E., Aberdeen. Harbour work, mostly in north of Scotland. Also drainage, water works & bridges; 1905-06, instr'man, C.P.R.; 1907-08, double-tracking, Smiths Falls to Montreal; 1909-10, recon. & location, Algoma Central surveys; 1911, formed firm of Fleming & Costello, built 5 miles Algoma Central; 1912, contract on Algoma Eastern; 1913, contract (Tomlinson & Fleming), 13 miles double tracking, C.P.R.; 1914-15, built dyke over Indian Bay for Greater Winnipeg Water District, W. G. Chace, ch. engr.; 1915-19, overseas, Infantry, Pioneers & Rly. Troops; 1919, joined firm of J. & L. M. Wood, Financial Agents, formed firm of Wood, Fleming & Co., Financial Agents & Contractors.

References: W. G. Chace, A. C. D. Blanchard, C. W. P. Ramsey, D. Hillman, M. V. Sauer, R. S. McCormick.

FORTIN—EDMOND, of Sudbury, Ont. Born at Sudbury, Oct. 14th, 1897; Educ., I.C.S.; 1913 (Feb.-May), on hydro survey, Onaping, Ont.; 1913 (May-Dec.), Rodman, C.P.R.; 1914 (Jan.-June), rodman & recorder, hydro survey, International Nickel Co.; 1914 (June-Dec.) & 1915 (March-June), rodman, C.P.R.; 1915-19, overseas, pilot officer, R.A.F.; 1920 to date, transitman on layout & constrn. of reinforced concrete bridges & gen'l rly. mtce., C.P.R.

References: S. B. McConnell, J. R. Caswell, T. B. Ballantyne, W. O. Cudworth, E. R. Clarke, R. A. Girouard.

FRASER—ARTHUR, of Calgary, Alta. Born at Aberdeen, Scotland, March 30th, 1871; Educ., Diploma, Royal Indian Engr'g College, Cooper Hill, 1896. Post grad. course in munic. engr'g & docks & hbrs., Univ. of London, 1919; 1896-99, road drainage work in Ceylon for Onnah Coffee Co.; 1900-01, served in South African war; 1902-04, surveys, estimates & plans for large sewage project in St. Petersburg, Russia under Hon. R. C. Parsons, M.I.C.E., Consltg. Engr., London, England; 1907-09, dftsman & asst. on constrn., City Engr's Dept., Edmonton; 1909-10, dftsman & instr'man on constrn., G.T.P. Ry.; 1910, asst. to L. T. Bray, D.L.S.; 1911, asst. engr. on sewerage & water works constrn.. town of Camrose, Alta., for Maxwell & Gregory, Consltg. Engrs., Vancouver; 1912, asst. to D. F. McEwen, D.L.S., in charge of party on twnshp. subdivn.; 1913-14, asst. to Harrison & Ponton, D.L.S. & Engrs., surveying mining claims & oil leases; 1914-19, overseas, Can. Engrs. & R.A.F.; 1920 to date, engr'g clerk, topog'l surveys branch, Dept. of the Interior, Calgary.

References: G. E. Bell, L. T. Bray, A. W. Haddow, C. J. Mackenzie, C. Ewart, M. A. Maxwell, H. E. Read.

FULTON—WILLIAM J., of Walkerville, Ont. Born at Oakville, Ont., July 4th, 1892; Educ., B.A.Sc. (Honours), Univ. of Toronto, 1915; O.L.S. Cert.; Summers 1910-14, with Abrey & Co., O.L.S., as instr'man, dftsman & in charge of subdivision work; 1915-16, chief asst. on city surveys with above firm; 1917-18, insp'r & asst. chief insp'r., Imp. Munitions Board & Aeronautic Inspection Directorate; 1919-20, chief insp'r & dept. foreman, Goodyear Tire & Rubber Co.; Oct. 1920, surveys, Dept. of Public Highways, Ont.; At present asst. engr., Morris Knowles, Ltd., Windsor, Ont.

References: C. E. Handerson, J. B. C. Keith, J. E. Hollaman, J. E. Porter, C. R. McCort, E. V. Deverall.

GALEA—ARTHUR FREDERICK, of Toronto, Ont. Born at Valletta, Malta, June 12th, 1877; Educ., Architect & Land Surveyor, Malta University, 1900; 1900-11, private practice, Malta. Executed numerous bldgs., in charge of engr'g as well as arch'l part of work; 1911-13, dfting & prelim estimates under H. K. Wicksteed, C.N.R.; 1913-date, with H.E.P.C. of Ontario on design of transformer stations, power houses etc. Arch'tl, constructional & struct'l designs and at present struct'l steel designer.

References: J. McNiven, F. B. Goedike, J. C. N. B. Krumm, H. V. Armstrong, H. Wykes, E. E. Wells, H. K. Wicksteed.

GOUGH—JOHN BERNARD, of Grand Mere, Que. Born at Liverpool, England, April 10th, 1884; Educ., Liverpool College, 1895-1900. Evening Tech. Classes, 1900-05. L. Univ. Extension Lectures, 1905-08. Lecturer in mach. drawing etc., Liverpool Evening Technical Schools, 1905-08; 1900-03, ap'tice, Arrowsmith, Sinclair Eng. Co., Engrs.; 1903-06, dftsman, 1906-08, designer, Hele-Shaw Clutch Co., Liverpool; 1908-10, dftsman, Angus Shops, C.P.R.; 1910-12, designer, power house design, Shawinigan Water Co., Montreal; 1912, designer, Jeffrey Mfg. Co., Montreal, Conveyors; 1912-14, designer & checker, Dominion Bridge Co., Lachine. Cranes, sluice gates & mech. bridges; 1914, chief dftsman with above company; 1915-18, chief dftsman, factory bldgs. & chem. equipment, Canadian Electro Products & American Electro Products Cos., Shawinigan Falls, Que. (Subsidary of Shawinigan Water & Power Co.); 1918 to date, chief dftsman, factory bldgs. & mech. equipment for manufacturing pulp & paper, Laurentide Co., Grand Mere.

References: J. C. Smith, H. H. Vaughan, G. H. Duggan, H. O. Keay, S. Svenningsen, D. C. Tennant.

GRAY—FRANCIS WILLIAM, of Ste. Anne de Bellevue, Que. Born at Hoyland Nether, South Yorkshire, England, April 15th, 1877; Educ., 3 yrs. short course in mining engr'g., Univ. of Sheffield, 1897-99. Night classes and private study. Member, Inst. of Mining Engrs.; 1891-1904, pupil under G. B. Walker, mining engr., Wharncliffe Silkstone Collieries. At same time attending mining classes; 1900-04, responsible charge of all colliery plans and surveys for two independent collieries (Wharncliffe Silkstone & Lidgett) while employed with Walker & Hardwick, Consltg Mining Engrs. & Surveyors, Sheffield; Also taught surveying at Short Course Classes at Sheffield Univ. under Prof. Hardwick; 1904-18, gen. executive asst. in office of general manager, Dominion Coal Co., work partly clerical and partly technical; 1918-19, asst. to pres. Nova Scotia Steel Co.; At present Editor of "Canadian Mining Journal" and "Iron & Steel of Canada."

References: G. H. Duggan, D. H. McDougall, G. D. Macdougall, C. M. Odell, M. J. Butler, D. Morrison, J. S. Whyte.

GRIGG—CHARLES DUNCAN, of Windsor, Ont. Born at Toronto, Ont., Aug. 1st, 1891; Educ., Tech. High School, 2 yrs., I.C.S., Home Study; 1912-14, rodman, record-man & dftsman, C.P.R., London, Ont.; 1914-15, instr'man, C.P.R.; 1915-19, overseas; 1919 (Apr.-July), instr'man, Capreol divn., July 1919 to Jan. 1920, res. engr., Ottawa divn., C.N.R.; 1920 (Mar.-Nov.), res. engr. for W. J. Miller, C. E. & Surveyor, Detroit, Mich.; At present instr'man with H. W. Patterson, town engr., Walkerville & Ford City.

References: C. E. White, T. E. A. Hall, W. A. Ewing, G. P. MacLaren, C. R. McColl.

HALL—WALTER ELTEN LOGAN, of Hantsport, N.S. Born at Sheet Harbor, N.S., Feb. 13th, 1886; Educ., 1 term Dalhousie Univ., Corres. & home study; 1910-12, underground official, coal mining, Dominion Coal Co., Glace Bay, N.S.; 1912-13. transitman in charge of party, Dom. Coal Co.; 1913, manager's cert., coal mining operations; 1913-14, asst. engr.. town of Glace Bay; 1914, private contracting, constrn. water works, concrete, etc.; 1915. overseas, Lieut.; 1917-19, engr. in charge of layout, Bye-product & Coke Plant (Koppers); At present divn. engr., Prov. Highways Broad, Nova Scotia.

References: H. Donkin, J. W. Roland, J. E. Belliveau, D. Morrison, C. A. MacNearney, R. W. McColough, H. F. Laurence.

HARVEY—CHARLES, of Temiskaming, Que. Born at Cummingsville, Ont., May 5th, 1874; Educ., B.A.Sc., Univ. of Toronto, 1901. D.L.S., B.C.L.S.; 1900, res. engr. on constrn. C.N.R.; 1901-02, asst. on D.L.S. govt. surveys; 1903, in full charge of party on D. L. survey work; 1904 to date (with exception of overseas service, 1917-18) private practice, civil engr'g and surveying, Kelowna, B.C., Chief engr., Okanagan Power & Development Co. and many other undertakings; At present insp'r of bldg. constrn., Riorden Co., Temiskaming, Que.

References: F. W. Groves, R. A. Girouard, E. R. Gray, J. E. Pringle, R. C. Purser.

HAY—ADAM, of Toronto, Ont. Born at Aberdeen, Scotland, Dec. 25th, 1883; Educ., Robert Gordon's College, Aberdeen, Ap'tice dftsman with Messrs. I. M. Henderson & Co., Engrs., Aberdeen; Dftsman, Messrs. Vicker Sons & Maxim Ltd., London, England; 1908-11, designing dftsman, Dominion Bridge Co., Montreal; 1911 (Jan.-Nov.), on design of power house, Shawinigan Water & Power Co., Montreal; 1911-13, plant constrn. engr., Canada Car & Foundry Co.. Montreal; 1913 (Feb.-Aug.), asst. bridge engr., The Lake Erie Northern Rly., Brantford, Ont.; 1913-16, on design and 1½ years in charge of constrn. & inspection, Bloor St. Viaduct, Works Dept., City of Toronto; 1916-18, with F. G. Engholm, C.E.. Toronto, as res. engr. on reinforced concrete structures, and preparing plans for bridges, 1918 (July-Dec.), checker in dfting dept., Canadian Aeroplanes Ltd.; 1918 to date, on design of bridges & culverts, engr'g dept., Ontario Public Highways.

References: T. Taylor, F. G. Engholm, J. M. M. Greig, W. A. McLean, G. Hogarth, H. W. D. Armstrong.

HILL—SHERWOOD NORMAN, of Ottawa, Ont. Born at London, Ont., March 22nd, 1881; Educ., Grad. Mining Engr'g., S.P.S., 1904, C.E. 1914, Univ. of Toronto; 1901 & 02 (summers), railroad constrn., Ontario Land Surveys; 1903 (summer), roadways dept., city engr's staff, Toronto; 1904 to date, with Topog'l Surveys, Dept. of the Interior, Ottawa, as follows, 1904-08, examinations & checking D.L. Surveys, 1908 to date, asst. chief of divn. of surveys examination branch.

References: G. H. Heriott, C. Rinfret, F. V Seibert, P. E. Palmer, G. C. Cowper.

HOLLAND—ERNEST JAMES, of Islington, Ont. Born at Iver, Bucks., England, July 30th, 1881. Educ., 3 yrs. Bright School of Science, Brighton, England; Pupil for 3 yrs. under H. V. Crawfurth Smith, A.M.I.C.E., engr. in charge Aldrington Parish, Sussex, England, 1906-07, asst. to H. V. Crawfurth Smith; 1907-12, successor to above; 1912 (March-June), asst. city engr., Kitchener, Ont.; 1912 (June-Sept.), asst. city engr., Guelph, Ont.; 1912-16, city engr. Guelph, Ont.; 1916-17, private practice, Mining work; 1917-19, constrn. engr., International Harvester Co., Hamilton Works, Ont.; March 1920 to date, asst. designing engr., Toronto Harbour Commission.

References: J. G. E. Wainwright, G. T. Clark, H. A. Goldman, N. D. Wilson, L. F. Willsie, H. P. Heywood, J. Mack.

HOPE—CHARLES VINCENT, of Islay, Alta. Born at Welton, Lincolnshire, England, June 20th, 1879; Educ., Oxford Senior, 1896; 1908-11, rodman, constr. & location, C.N.R.; Dec. 1910-Mar. 1911, transitman for L.R. Ord, D.L.S.; 1910 (July-Nov.) & 1911-14, asst. engr., C.N.R., 1914 (May-Dec.), charge of field work, concrete arch bridges, City of Calgary; 1917-18, overseas, enlisted as sapper, rec'd comm'n. Jan. 1918; May 1919 to date, res. engr., C.N.R.

References: H. A. Dixon, W. Burns, E. K. Hall, W. Walkden, W. S. H. Hutton, E. F. Pullen.

HUGHSON—JOHN WARD, of Ottawa, Ont. Born at Albany, N.Y., U.S.A., Oct. 5th, 1890; Educ., B.Sc. (Mech. Engr.), McGill Univ., 1912; 1912-16, with Gillmor & Hughson, Ltd. Hull, Que.; 1916-18, overseas, Capt., Can. Forestry Corps; 1918-19, engr. in charge of Tidewater Paper Mills, Brooklyn, N.Y.; May 1920 to date, with the Montreal Engr'g Co., Ltd.

References: J. B. McRae, G. G. Gale, D. H. Nelles, F. E. Bronson C. R. Coutlee, R. O. Sweezy.

HYSLOP—JAMES, of Toronto, Ont. Born at Castle Douglas, Scotland. May 24th, 1870; Educ., Heriot Watt College, Edinburgh; Member Western Society of Engrs., Chicago; 1885-1890, ap'tice machinist, Dumfries Iron Works, Scotland; 1894, dftsman, Grant Locomotive Works, Chicago; 1895-97, dftsman, Whiting Foundry Equipment Co.; 1897-1912, designing engr., in charge of dfting room; 1913-20, with Greater Winnipeg Water District as follows, 1913-18, mech. engr., 1918-19, designing engr., 1919-20, mech. engr.; 1920 to date, with Kerry & Chace, Toronto.

References: W. G. Chace, M. V. Sauer, G. F. Richan, J. Armstrong, D. L. McLean, H. R. McClymont.

JOSLIN—JAMES ALEXANDER, of Toronto, Ont. Born at Boxhill-on-Sea, Sussex, England, Oct. 24th, 1893; Educ., Struct'l dfting, I.C.S. Struct'l design, Central Technical School, Toronto, Home study; 1913-14, 1 year shop experience, Dominion Bridge Co., Toronto; 1916 (6 mos.), dftsman on constrn., The R. Simpson Co. Lt., Toronto; 1917-19, struct'l detailer, and 1919 to date, struct'l checker and squad leader, Dominion Bridge Co., Toronto.

References: E. S. Mattice, G. E. Evans, W. W. Gunn, J. W. Smith, E. V. Deverall, J. G. Jack.

KENNEDY—HENRY GEORGE, of Gowganda, Ont. Born at Moose Jaw, Sask., Jan. 15th, 1884; Educ., B.A.Sc., Univ. of Toronto, 1911; 1904-08, course in mining, Univ. of Toronto; 1903-04, practical course, elec. engr'g., Can. General Elec. Co., Peterboro; 1909-10, surveyor & engr. for Silvestld & Mann Mine, Gowganda; 1911-12, asst. surveyor, O'Brien Mine, Cobalt; 1912-15, res. engr., Cobalt Lake Mining Co., Cobalt; 1915-18, mgr., Pas Consolidated Mines, Winnipeg & engr., Rex Mine, Herb Lake, Man.; 1918-20, surveyor, O'Brien Mine, Cobalt; march 1920 to date, gen. supt., Miller Lake O'Brien Mine, Gowganda, Ont.

References: C. H. Mitchell, H. E. T. Haultain, A. D. Campbell, J. A. Reid, H. W. Sutcliffe.

KENNEDY—HOWARD, of Dunrobin, Ont. Born at Dunrobin, May 31st 1892; Educ., B.Sc., McGill Univ., 1914; 2 summers as student asst., topog'l surveys, mines branch, Dept. of Mines, Ottawa; 2 summers in charge of party, topography for mines branch; 4 yrs. overseas, Lieut. & Capt., Can. Engrs. Wounded; Oct. 1919 to date, with Lockwood Greene & Co. of Canada, Ltd., 3 mos. in dfting office, 3 mos. as asst. res. engr., Dominion Tire Factory, Kitchener, 6 mos. as res. engr., Maple Leaf Rubber Factory, Port Dalhousie.

References: C. S. L. Hertzberg, E. G. Horne, A. R. Sprenger, G. S. Baxter, A. Macphail.

LEE—ARTHUR ROLLAND, of Ottawa, Ont. Born at St. John, N.B., Jan. 16th, 1894; Educ., Architect student with F. N. Brodie, St. John, N.B., 1909. Trinity College School, Port Hope, Ont., 1910; 1913 to date, instr'man, hydrographic survey, Dept. of the Naval Service, Ottawa.

References: C. F. Hanington, F. J. Delaute, G. H. Frith, C. R. Coutlee, W. C. Ewing.

LOOK—RICHARD VEECH, of Toronto, Ont. Born at Louisville, Kentucky, U.S.A., June 7th, 1878; President, Canada Creosoting Co. Ltd., Toronto.

References: J. M. R. Fairbairn, A. C. Mackenzie, F. L. C. Bond, H. T. Hazen, P. B. Motley.

MacDERMONT—EDWARD CARRINGTON, of Sanderstead, Surrey England. Born at Kingston, Jamaica, B.W.I., June 3rd, 1886. Educ., B.Sc. (C.E.), McGill Univ. 1912. 1911, timekpr., costkpr. & asst. supt. of laying of concrete, Montreal General Hospital Extension & Birks office bldg., Montreal, 1912 (2 mos.), in drawing office of res. engr., C.N.R., 1912, steel design, Bank of B.N.A. Bldg., Montreal, 1912-13, architect's insp'r, Wesleyan Theological College, Montreal; 1913-14, designer and builder of two country houses near Montreal; 1914-15, asst. to Quebec Land Surveyor, Montreal & Quebec Province; 1915-19, overseas, sapper Can. Engr., Lieut., Royal Engrs.; 1919-20, 1½ yrs., engr'g dept., S. Pearson & Son Ltd., dfting and taking out quantities for tunnelling, dock and reservoir works, At present engr. and dftsman in Bridge Dept. of London County Council, England

References: W. D. Staveley, E. Brown, H. M. MacKay, R. A. C. Henry, S. G. MacDermot.

MACKENZIE—ALEXANDER MACDONALD, of Lachine, Que. Born at Guelph, Ont., June 13th, 1891; Educ., B.A.Sc., 1914, E.E., 1920, Univ. of Toronto Assoc. Member A.I.E.E., 1914; 2 yrs. instructor, Electrotechnics, Montreal Technical High School (evening); 1918-19, overseas, Lieut., Can. Engrs.; 1908 to date (with exception of overseas service and college years), with Bell Telephone Co. as follows: 1908-10, tel. line constrn. & repair work, central office switchboard mtce.; 1914-15, wire chief, Guelph, Ont., in charge of mtce & constrn.; 1915-18, engr'g dept.; 1919 to date, transmission engr., in charge of design of tel. plant to conform to transmission standards.

References: G. M. Hudson, A. B. Manson, J. D. Peart, J. R. Montague, T. R. Loudon.

MacLELLAN—FREDERICK GERALD, of Moncton, N.B. Born at Campbellton, N.B., July 21st, 1893; Educ., Course in surveying and mapping, I.C.S.; 1913, location party, I.R.C.; 1914, rodman, 1915, leveller & topog'r. with same; 1915-19, overseas, Can. Pioneers; 1919, leveller, mtce of way, C.N.R.; 1920, transitman, C.N.R.; At present transitman, divn. engr's office, C.N.R., Moncton, N.B.

References: R. H. Emmerson, J. S. O'Dwyer, W. A. Duff, E. G. Evans, J. D. McBeath, J. H. Congdon.

MARSHALL—ROBERT JOHN, of Toronto, Ont. Born at Galt, Ont., Aug. 12th, 1884; Educ., B.A.Sc., Univ. of Toronto, 1908; 1906, instr'man, C.N.R.; 1907, instr'man, twnshp. subdivision; 1909, prelim. surveys on power sights for C. H. & P. H. Mitchell; 1910 (6 mos.), asst. to res. engr., G.T.P., Edmonton-Edson Divn.; 1911 (6 mos.), designing dpt., Dominion Bridge Co., Lachine; 1912 (6 mos.), contracting, York County engr.; 1914, town engr., Trenton, Ont., in charge of constrn. of sewer system; 1915-19, operating a laboratory, testing shell steel; 1919 to date, pres., Canadian Inspection & Testing Co. Ltd., Toronto.

References: P. Gillespie, C. H. Mitchell, T. H. Hogg, C. R. Young, T. R. Loudon.

MARSTON—GUY REEVES, of Simcoe. Ont. Born at Birmingham, England, May 22nd, 1879; Educ., Christs Hospital, London. Science Course Birmingham Technical School. City & Guilds of London Institute; 1903, asst. to Chas. Clark, M. E., Staffordshire, England; 1904-08, asst. to C. C. Fairchild, C.E., D.L.S.; 1909-10, asst. to W. H. Fairchild, O. L. S., county engr., Brant & Norfolk; 1911, appointed town engr., Simcoe, 1912, county engr., Norfolk, and 1917 supt. county roads, Norfolk, occupying these positions at the present time.

References: W. A. McLean, W. Chipman, G. Hogarth, E. H. Darling, A. M. Jackson.

MASON—FRANK HARRISON, of Niagara Falls, Ont. Born at Yorkton, Sask., June 2nd, 1890; Educ., Completed 3rd year, M.E., S.P.S., Univ. of Toronto, 1914. Course in struct'l engr'g and design, I.C.S.; 1908 (6 mos.), mach. shop, The Goldie & McCulloch Co., Galt.; 1911 (6 mos.), mach. shop, Canadian Rumley Co., Toronto; 1912 (6 mos.), dfting, bridge & struct'l office, Canada Foundry Co., Toronto; 1913 (6 mos.), reinforced concrete design & detail, The Trussed Concrete Steel Co. Ltd., Walkerville, Ont.; 1914-15, detailing & checking, American Bridge Co., Chicago office; 1916-19, 1st. Lieut., H. M. Navy; 1919 to 20, detail, ckecking & designing struct'l steel, Good Year Tire & Rubber Co., Toronto. Six mos in charge Struct'l steel & bldg. work in office; At present, designing dftsman, H.E.P.C., Niagara Falls.

References: R. P. Johnson, H. F. H. Hertzberg, C. R. Young, F. G. Smith, A. C. Brown, J. M. Morton.

MASON—HORACE NEVILLE, of Toronto, Ont. Born at London, England, May 1st, 1889; Educ., Dulwich College, Sydenham, England; 1905-09, with Mayoh & Haley and Fulham Steel Works, London, England; 1914-15, estimating & designing, Redpath Brown & Co., London, England; 1909-14 and 1915 to date, with Dominion Bridge Co. Of this time 4 yrs. as asst. squad leader, 1 yr. asst. plant engr., 6 mos. designing & estimating & 6 mos. contracting engr. at Montreal. At present contracting engr., in charge of tenders etc. for Toronto office.

References: P. L. Pratley, A. Peden, F. P. Shearwood, W. W. Gunn, E. S. Mattice, D. C. Tennant, A. H. Harkness.

McDONELL—FRANK, of Ottawa, Ont. Born at Randolstown, Co. Antrim, Ireland, Oct. 18th, 1877; Educ., 3rd year, Royal Univ. of Ireland. 4 yr. course, Technical Inst., Belfast; 5 yrs. ap'ticeship mech. engr'g., shop and drawing office; 2 yrs. marine engr. at sea; 2 yrs. mech. engr., gold mines, Transvaal, S.A.; 6 yrs. mech. engr., design, install'n & mtce., & inspection power driven fog alarm machinery, Marine Dept., Dom. Govt.; 9 yrs. Steamship Inspection Service, Marine Dept., 6 yrs. of which asst. to chief of branch & 3 yrs. in full charge; At present, Chairman, Broad of Steamship Inspection, Marine Dept., Dom. Govt.

References: B. H. Fraser, V. F. W. Forneret, C. P. Edwards, K. M. Cameron, G. Grant.

McILHARGEY—PARTIC EUGENE, of Toronto, Ont. Born at Stratford, Ont., March 9th, 1896; Educ., B.A.Sc., Univ. of Toronto, 1917, 6 mos. asst. to supt. of shell dept. Can. Allis Chalmers, Stratford Plant; 1917 (May-Nov.), asst. to C. Webster, plant supt. & engr., Sheldons Ltd., Galt, Ont.; 1917-18, presiding chief examiner, Aircraft Inspection Dept., Imperial Munitions Board, Toronto; 1919-20 (4 mos.), mach. designer, Goodyear Tire & Rubber Co., New Toronto; March 1920 to date, sales engr., Lincoln Electric Co., Toronto.

References: P. Gillespie, C. R. Young, L. M. Arkley, S. C. Bothwell, A. F. Hanly.

MILLARD—CLARENCE STEPHEN, of Copper Cliff, Ont. Born at Bath, England, May 5th, 1885; 1907-09, with Henry DeQ. Sewell, O.L.S., Toronto; 1909-11, transitman, Routly & Summers, Engrs., Haileybury, Ont., 1 year in charge of survey party, 1 year asst. to town engr.; 1911-12, dftsman, recorder's office, Porcupine, Ont.; 1912-13, survey dept., City of Toronto; 1913 (June-Dec.), bridge dept., Canada Foundry Co.; 1913-14, struct'l steel detailing, Dominion Bridge Co., Toronto; 1914 (June-Dec.), struct'l steel detailer, Toronto Struct'l Steel Co., Toronto; 1916 (Jan.-Nov.), struct'l steel design, McGregor & McIntyre, Toronto; 1916-18, and 1919 (Feb.-Sept.) smelter constrn. and struct'l steel design, British America Nickel Corpn., Nickelton, Ont.; 1918 to date (with exception of Feb. to Sept. 1919), reinforced concrete & struct'l steel design, International Nickel Co. of Canada.

References: H. E. T. Haultain, J. A. Donovan, J. B. D'Aeth, E. L. Pettingill, J. P. Gordon, G. Lynch.

MILLER—WALTER ST. JOHN, of Calgary, Alta. Born at Richmond, Surrey, England, Feb. 11th, 1880; Educ., 3 years South London Polytechnic, Diploma, 1901. 13 years Member, Can. Inst. Mining & Metallurgy. Resigned 1920; 1901-03, first asst. engr., Elect'l Standards Laboratory, Board of Trade (Civil Service), London, England; 1903-06, mech. dftsman, Rand Mines, South Africa; 1906 (8 mos.), supt. constrn. mill bldgs., engine & boiler house, crushing & separating plant, South African Land & Exploration Co., Transvaal; 1907, gen'. mining, South Africa; 1907-08, asst. engr., Granby Mining & Smelting, Grand Forks, B.C.; 1908-12, asst. engr. & surveyor, Inspiration Copper Co., Arizona; 1912, private blue printing & arch'l business, Calgary; 1913, arch'l engr., Lange Engr'g Co., Medicine Hat, Alta.; 1915-17, asst. engr., irrig. branch, Dept. of the Interior 1917-19, overseas, O.C. Engineer repair station & shops, Royal Air Force, Egypt; At present chief dftsman, Reclamation Service, Dept. of the Interior, Calgary.

References: F. H. Peters, P. J. Jennings, A. L. Ford, F. K. Beach, V. M. Meek, C. M. Arnold.

MILLER—WILLIAM JOHN, of Ottawa, Ont. Born at Edinburgh, Scotland, Dec. 23rd, 1892; Educ., Murry House Normanl, Edinburgh. Private study; 2 yrs. in elect'l testing laboratory; 6 mos. machine shop; 6 mos. armature winding; 6 mos. brass finishing; 3 mos. underground cable constrn.; 1 year in charge elect'l constrn.; 8 yrs. hydrographic survey (inc. 5 years overseas); 1914-1919, overseas. Enlisted as private, discharged as Lieut.; At present, hydrographic recorder, hydrographic survey, Ottawa.

References: C. F. Hanington, N. B. McLean, F. J. Delaute, C. R. Coutlee, G. H. Frith.

MILTON—CHARLES WILLIAM, of Moncton, N.B. Born at Albert Mines, N.B.; Educ., 2 yrs. engr'g course, Mount Allison Univ., 1909-11; 1911-12, rodman on prelim. & location, Stevens Constrn. Co.; 1912-13, instr'man, mine surveying, New Brunswick Shade Development Co ; 1913-15, rodman, C.N.R.; 1915-16, leveller, C.N.R.; 1916-17, instr'man, C.N.R.; 1917 to date, first asst., divn. engr's office, C.N.R., Moncton.

References: R. H. Emmerson, J. D. McBeath, P. C. Kirkpatrick, R. H. Smith, S. B. Wass, K. S. Pickard, J. S. O'Dwyer, A. D. W. Cuthbert.

MONTGOMERY—ROYAL HARP, of Calgary, Alta. Born at Brantford, Ont., May 20th, 1882; Educ., Grad., M.E., S.P.S., 1903, B.A.Sc. (Honours), 1905, Univ. of Toronto; Dominion Topog'l Surveyor Cert., 1920; 1900 (4 mos.), dftsman, Waterous Engine Works, Brantford; 1901 (5 mos.), asst. to city engr., Brantford; 1902 (5 mos.), instr'man on mtce & constrn., G.T.R., Hamilton; 1903-04, engr'g clerk, topog'l surveys branch, Ottawa; 1904, asst. on subdivn. surveys in Alta.; 1905-06, asst. on hydro survey, Dept. of Marine & Fisheries, Ottawa; 1906, charge of party on subdivn. survey on Dominion lands in Northern Alta.; 1907-15, private practice as civil engr. & surveyor, In charge of design and constrn. of various engr'g works; 1915-17, unable to enlist but gave up practice and farmed; 1917, resumed private practice; 1918 to date, chief of party on control levelling, topog'l surveys branch, Dept. of the Interior, Calgary.

References: W. E. Douglas, E. H. Phillips, J. B. Challies, M. B. Weekes, A. Smith, A. L. Ford.

MOORE—ROBERT H., of Toronto, Ont. Born at Chicago, Ill., Jan. 29th, 1871; Educ., Engr'g School at Lebanon, Ohio, 1891; 1892-97, engr'g dept., Pennsylvania Lines; 1897-1902, asst. engr., Cincinnati Northern Rly.; 1902-03, asst. engr., 1903-04, res. engr., 1904-07, engr., mtce of way, Big 4 Rly.; 1907-20, asst. gen'l supt. & chief engr. ,American Creosoting Co.; 1920 to date, gen'l supt. in charge of constrn. & operation, Canada Creosoting Co., Toronto.

References: J. M. R. Fairbairn, A. C. Mackenzie, W. Armstrong, H. T. Hazen, P. B. Motley.

MOORE—WILLIAM JAMES, of Ottawa, Ont. Born at Brockville, Ont., Feb. 24th, 1891; Educ., 1st year Arts, Kings University; 1910-12, rodman, leveller, divn'l clerk, N.T.C.Rly.; 1913-20, asst. to Dist. Engr. Chapleau, D.P.W., Ottawa, as instr'man on surveys & gen. engr'g office work; At present asst. to H. M. Davy, Chief of Borings, D.P.W., Ottawa.

References: C. R. Coutlee, S. J. Chapleau, H. M. Davy, A. St. Laurent, D. W. Jamieson, K. M. Cameron.

NICHOLS—IRA JOHNSON, of Jasper, Alta. Born at Lachine, Que., Dec. 14th, 1886; 1905-07, bridgeman on erection of bridges & bldgs., Dominion Bridge Co.; 1907, in charge of assembling of steel for I.C.R. at Moncton & Halifax; 1909-10, sub-foreman on erection, Dominion Bridge Co.; 1910, with Canadian Inspection Co.; 1911, with G.T.R. under J. G. Legrand, bridge engr., as bridge insp'r. in charge of inspection during erection of bridges, etc.; At present, bridge insp'r., C.N.T. west of Armstrong & Fort William to the coast, under J. G. Legrand.

References: P. Johnson, J. G. Legrand, J. A. Heaman, W. S. Fetherstonhaugh, R. W. Ross, W. Walkden, M. A. Burbank.

OSBORNE—GURDON HOARD, of Montreal, Que. Born at Warren, Mich., U.S.A., May 3rd, 1889; Educ., B.S., Mich. Agric. College, 1911; 1911-19, with American Blower Co. as follows:—1911-12, student dales engr., Detroit. 1912-17, sales engr., Chicago office. 1917-19, mgr., sales office, Milwaukee, Wis. 1919, transferred to Windsor, Ont., by the American Blower Co., in charge of sales engr'g for their Canadian Associate The Canadian Sirocco Co. Ltd., Jan. 1920, headquarters changed to Montreal. Since that time mgr. of sales engr'g for this firm.

References: E. A. Ryan, F. A. Combe, G. P. Cole, H. W. Racey, M. A. Sammett.

OUTRAM—ALFRED ALLAN, of Port Hope, Ont. Born at Port Hope, Sept. 13th, 1895; 1914, with Smith & Smith, O.L.S., Lindsay, Ont.; 1915, rodman, munic. surveys, F. W. Thorold, Toronto; 1915-19, overseas; 1919-20, topog'r., H.E.P.C. rly. location; 1920 (Mar.-Aug.), rodman, Queenston-Chippawa Power Canal; 1920 (Aug.-Sept.), concrete insp'r., Dept. Public Highways of Ontario; Sept. 1920 to date, instr'man, dept. Public Highways of Ontario.

References: J. H. Congdon, H. Robertson, C. H. McDougal, A. C. D. Blanchard, G. R. Taylor.

PATERSON—ALEXANDER WILSON, of Winnipeg, Man. Born at Abington, Lanarkshire, Scotland, Jan. 28th, 1880; Educ., Godolphin School, London, England. 1900-02, engr'g classes, Heriott Watt Institute, Edinburgh; 4 yrs. ap'ticeship to Messrs. Leadbitter & Fairley, Engrs. & Surveyors, Edinburgh; 1904 to date (with exception of overseas service) with C.P.R. as follows:—1904-06, rodman etc., on surveys, 1906-11, instr'man and dftsman on location & constrn., 1911-15 and 1919 to date, res. engr.; 1915-19, overseas, Lieut. & Capt., Royal Engrs.

References: W. A. James, C. Flint, J. G. Reid, V. Michie, J. R. C. Macredie, C. H. Larson, J. G. Reid, T. C. Macnabb.

PEAKER—WILLIAM JAMES, of Ottawa, Ont. Born at Brampton, Ont., June 23rd, 1884; Educ., Grad. S.P.S. Univ. of Toronto, 1904; 1905-07, Lake Superior Power Co., Sault Ste Marie, Ont.; 1907 (May-Dec.), T. & N.O.Rly.; 1908-20, with topog'l surveys branch, 1908-11, dftsman, 1911-18, asst. chief of divn., 1918-20, office engr.; Oct. 1920 to date, office engr., Natural Resources Intelligence Branch, Dept. of the Interior, Ottawa.

References: J. B. Challies, G. B. Dodge, R. J. Burley, F. H. Kitton, G. H. Herriot, P. Sherrin, O. S. Finnie.

PENNOCK—FREDERICK WILLIAM, of Montreal, Que. Born at Winnipeg, Man., Sept. 10th, 1888; Educ., Home study. I.C.S.; Served time as machinist, Canada Atlantic Ry., Ottawa, 1904; 12 years with C.P.R. on steam & elect'l engr'g., constrn. & mtce from Winnipeg east; 2 yrs., electrical engr., Imperial Munitions Board; At present Managing director, Cleaton Co., (Canada) Ltd., Engineers.

References: J. T. Farmer, F. A. Combe, H. Wright, K. B. Thornton, R. A. Ross.

PORTER—CECIL GEORGE, of Montreal, Que. Born at St. John, N.B., Oct. 9th, 1887; Educ., B.Sc., McGill Univ., 1911. Research Fellowship in Metallurgy, 1911-12. M.Sc., McGill Univ., 1913; 1907 (summer), Nova Scotia Steel & Coal Co.; 1907-08, Bethlehem Steel Co., Bethlehem, Pa.; 1909-10 (summers), Dominion Iron & Steel Co., Sydney, N.S.; 1912-13, Tivani Steel Co., on design ,and erection of one ton plant at Belleville, Ont.; 1913-14, Douglas Milligan Co., on engr'g sales; 1914-19, overseas, mlt. Col., 1917-19 (2 mos. excepted), in command of Battn. of Infantry in the field or a Reserve Battn. in England. Awarded D.S.O. and mentioned in despatches 4 times; May 1919 to date, mgr., Douglas Milligan Co. Ltd., Montreal.

References: A. Stansfield, A. E. Dubuc, F. F. Miller, C. L. Cantley, J. C. Kemp, G. M. Wynn, W. S. Lea, F. Peden.

RAINE—HERBERT, of Toronto, Ont. Born at Tullamore, Ont., Jan. 23rd, 1882; Educ., Grad. S.P.S., Univ. of Toronto, 1907; 5 years dftsman., Hamilton Bridge Works; 2 yrs. designing engr. & asst. chief with Prack & Perrine, Arch'ts & Engrs.; 3 yrs., checker & designer, McGregor & McIntyre, Ltd.; 2 yrs., bldg. engr., H.E.P.C.; 1 year to date, engr. for Peckover's Ltd., Toronto.

References: R. K. Palmer, C. H. Marrs, H. E. Darling, A. R. Robertson, F. M. Byam.

ROBERTS—JACK, of Toronto, Ont. Born at Bolton, England, Aug 19th, 1890; Educ., 2 yrs Harris Inst (Engr'g School), Preston, England. 1906-08 I C S; 1908-11, articled pupil to Arnold England, Architect & Surveyor, St Annes-on-Sea, England; 1911-14, with above as instr'man & dftsman, engaged in design of public bldgs., town surveying, supervising constrn. of roads & sewers etc ; 1916-19, overseas; 1914 to date (with exception of overseas service), dftsman, sewer dept , Dept. of Works, Toronto.

References: G. Phelps, C. L. Fellowes, J. Milne J. H Nevitt, W. R. Worthington, T. Taylor.

ROBERTS—WILLIS HORATIO, of Perth, Ont Born at Sharbot Lake, Ont., Jan. 13th, 1888; Educ., 3 years civil engr'g., 1 year Arts, Queen's Univ., 1904-08; 1905-06 (summers) mtce. dept., C.P.R. under H. C. Grout; 1908-09, rodman, dftsman & instr'man, C.P.R.; Fall 1909, contracting; 1910 (Apr.-July), topog'r , Southern New England Rly., Mass.; 1910-14, res. engr., constrn., C.P.R.; 1915-19, overseas, 1917-19, ch. engr., 6th Bn., C.R.T.; 1919 (May-Aug.), transitman on location, C.P.R.; 1919-20, terminal engr., Hydro-Electric Radials, Toronto; 1920 (Feb.-Dec.), asst. engr., C.P.R.; Not employed at present.

References: D. Hillman, C. W. P. Ramsey, C. T. DeLamere, K. Weatherbe, J. M. R. Fairbairn, J. C. N. B. Krumm, T. U. Fairlie.

ROBERTSON—FREDERICK JOHN, of Seebe, Alta. Born at Deal, England, March 1st, 1884; Educ., Normal Training School, Aberdeen, Scotland. Evening classes; Charge or shift engr., Aberdeen Corporation Electricity Works; With Calgary Power Co. Ltd., as station supt. for three years, and gen'l supt. for six years, which is present position.

References: G. W. Craig, F. H. Peters, R. S. Trowsdale.

ROBINSON—GEORGE GATES, of Toronto, Ont. Born at Weedsport, N.Y., Sept. 23rd, 1891; Educ., C.E., Cornell University, 1914; 1914-16, promotion & inspection engr., Highway Dept., Portland Cement Assn., Chicago; 1916-18, divn. engr., Publicity Dept., Canada Cement Co., Ltd.; March 1919, assisted in the formation of the Independent Concrete Pipe Co. Ltd., Woodstock, and taken active part in the management of its affairs since; May 1919 to date, sales engr., Jno. E. Russell Co. Also engr. for Independent Concrete Pipe Co. Ltd.

References: G. T. Clark, F. McArthur, G. G. Powell, R. O. Wynne-Roberts, J. B. Carswell, H. S. Van Scoyoc.

ROBINSON—WILLIAM ANDREW, of Winnipeg, Man. Born at Ludington, Mich., Feb. 21st, 1881; Educ., B.A. (Math.) Univ. of Manitoba, 1901. Grad. S.P.S. Univ. of Toronto, 1908; D.L.S. work under Jos. Doupe, D.L.S., Jno. Motley, D.L.S. & D. L. Townsend, D.L.S.; 1912, contract on survey work with Dom. Govt.; 1913-14, surveying right of way, for C.P.R.; 1915, engr. for Munic. of Dauphin, Man.; 1916 to date, engr. and dist. engr. Good Roads Board, Man.

References: A. McGillivray, M. A. Lyons, P. Burke-Gaffney, W. H. Hunt.

RUSH—WALTER ALBERT, of Ottawa, Ont. Born at London, England, April 25th, 1880; Educ., Diploma, Faraday House, London, England; Member Inst. of Radio Engrs., 1913; 1895-99, pupil with Chamberlins Ltd., Norwich, England, Govt. & Rly. Contractors; 1899-1900, with Imperial Forces in South Africa; 1901, ap'ticed with Pullin & Co., Elect'l & Mach'l Engrs., Newport, England; 1903-05, Bristol Corpn., Electric Light & Power Works; 1905-12, engr. with Can. Marconi Co., on constrn. & operation of Radio Stations on East Coast. Engr. in charge Cape Race Station, 1 year; 1912 to date, chief insp'r of Radio, Naval Dept., Ottawa. 1919 position reclassified as Divn. Supt., in charge of all operation of govt. Radio Stations East of Winnipeg, and of all radio exam. & insp'n staffs of the Dominion.

References: G. J. Desbarats, C. P. Edwards, J. Murphy, W. J. Stewart, A. B. Lambe, J. H. Thompson, T. C. Phillips, J. A. Wilson.

RYLEY—EDMUND GERALD, of Calgary, Alta. Born at Ottawa, Ont., Aug. 27th, 1890; Educ., B.Sc. (C.E.), McGill Univ., 1914; 1909 (9 mos.), with G.T.R.; (4 mos.), rodman, G.T.P.; 1911 & 1912 (4 mos. each), transitman, G.T.P.; 1913 (4 mos.), dftsman, Trussed Concrete Steel Co., Walkerville, Ont.; 1914-15, dftsman & engr., with above firm; 1915-17 & 1919 (Aug.-Dec.), office engr. for same firm in Norfolk, Va.; Dec. 1919 to date, engr. & branch engr., Trussed Concrete Steel Co., Calgary.

References: G. N. Houston, G. W. Craig, F. E. Emery, A. L. Ford, F. H Peters.

SANDERSON—ALLAN USILL, of Toronto, Ont. Born at Toronto, Dec. 14th, 1888; Educ., Ba.Sc., Univ. of Toronto, 1909; 1908, asst. engr., M. A. Pigott & Co., Guelph & Goderich Rld.; 1909, asst. engr., C.P.R.; 1910, asst. engr., Toronto Slow Sand Filtration Plant; 1911-13, asst. & res engr., design & constrn., Dept. of Work, Toronto; 1914, res. engr. on constrn., Drifting Sand Filtration Plant, Dept. of Work, Toronto; 1918 to date, supt., Filtration Plant, Toronto.

References: W. Gore, P. H. Mitchell, J. Milne, G. G. Powell, W. R. Worthington.

SANDERSON—CHARLES JAMES LACY, of Acme, Alta. Born at East Dulwich, London, England. July 16th, 1882; Educ., Polytechnic School of Engr'g., London, England, 1897-1901; 1901-06, 2 yrs. ap'ticeship and afterwards asst. with Symmons & Sharman, Civil Engrs., London, England; 1906-09, with R. M. Parkinson, A.M.I.C.E., Peterboro, England, as res. engr. on various works; 1909-10, contracting engr. with Robt. McAlpine & Sons, Glasgow; 1910-13, dftsman & transitman on location, C.P.R. constrn. dept.; 1913-14, instr'man in charge of constrn. of water stations; 1915-20, overseas, Lieut., Infantry, Can. Corps Light Rlys. & Royal Engrs.; April 1920 to date, in charge of constrn. of bridges under W. H. Tye, asst. engr , C.P.R.

References: W. A. James, J. R. C. Macredie, J. Callaghan, P. Weatherbe, H. W. Tye, R. P. Rogers, C. L. Hervey, D. Lyell.

SCHOLLS—JOSEPH, of Weyburn, Sask. Born at Chadderton, Lancashire, England, May 19th, 1870; Educ., Tideswell College, Derbyshire, England. Classes in engr'g., Geological Rooms, Manchester, England; 1893-1896, 3 yrs ap'ticeship with The Chamber Colliery Co., Oldham, Lancas., England, under Thos Fromer, M.E., C.E., and 10 years asst to W. W. Millington, M.E., surveyor etc., and mgr with the above firm. 1906-11, insp'r of works, City of Weyburn; 1911-16, supt of works City of Weyburn; 1916-18, acting city engr , City of Weyburn; March 1919 to date, supt of public works, City of Weyburn.

References B. S. McKenzie, W. T. Daniel, J. N deStein, R H Murray, J R C. Macredie, G. D. Mackie, O. W. Martyn.

SCOTT—ALEXANDER, of Charlottetown, P.E.I. Born at Kirkcaldy, Scotland, Sept. 6th, 1884; Pupil of city engr., Kirkcaldy, 1900-04; 1904-11, asst. to city engr., Kirkcaldy; 1911-13, dftsman, & 1913-14, instr'man on mtce , C.P.R.; 1914-15, charge of survey party, C.P.R ; 1915-16, asst. engr., Can Govt. Rlys., on resurvey of P.E.I. Rly.; 1916 to date, divn engr., C.N.R , in charge of P.E.I. divn.

References: C. B. Brown, W. A. Duff, H. J. Crudge, F. B. Tapley.

SEFTON—FRANK HUGH COTTERIL, of Toronto, Ont Born at Toronto, Oct. 20th, 1890; Educ., Mech. dfting., Toronto Technical School, 1908-09. C.E. course, I.C.S.; 1906-08, Crow's Nest Pass Coal Co.; 1909-10, coal prospect, with Jas. McEvoy, M.E., Alberta, Brazzean River, Brule Lake; 1911, with Speight & Van Nostrand & D. D. James, Surveyors, Toronto; 1911-12, instr'man., dept. rlys. & bridges, City of Toronto; 1913-14, with City of Toronto, bridge location surveys and res. engr., bridge constrn.; 1915-19, overseas, C.E.F. Infantry; 1919-20, res. engr., hospital constrn., Ste Agathe des Monts, D.S.C.R.; July 1920 to date, water power develop. surveys, Messrs. Kerry & Chace Ltd., Toronto.

References: G. A. McGarthy, H. W. McAll, D. W. Harvey, T. Taylor, A. T. C. McMaster, A. L. Mudge.

SHARPE—ALLAN PACKINGHAM, of Niagara-on-the-Lake, Ont. Born at Brantford, Ont., Jan. 15th, 1886; 1910-11, rodman, N.T.C.Ry.; 1911-12, rodman, Algoma Central Rly., location survey; 1912-13, instr'man & bridge insp'r., C.N.O. Ry. constrn.; 1913-14, concrete insp'r., Florida East Coast Rly.; 1914-15, concrete insp'r., Paducah & Illinois Ry.; 1915 (Apr.-Dec.), county bridge engr., Bureau Co., Ill.; 1916-18, engr. in charge of yard constrn., G.T.R., Detroit, Mich.; Instr'man, field dftsman, and at present foreman, sand & stone conveyors, H.E.P.C., Niagara Development.

References: A. C. D. Blanchard, G. H. Lowry, W. S. Orr, W. Jackson, J. H. MacKenzie.

SHEPHERD—DAVID, of Toronto, Ont. Born at Dundee, Scotland, July 20th, 1886; Educ., B.Sc. (Eng.), Edinburgh Univ., 1905. Assoc. M.I.C.E.; 1905-08, British Westinghouse Co., Manchester, England; 1908-10, asst. res. engr. on steam electric power developments, and 1910-12, res. engr., Balfour Beatty & Co. Ltd., London, England; 1912-14, hydro-elec. power develop. design, & constrn., with C. H. & P. H. Mitchell, Consltg. Engrs., Toronto; 1914-19, overseas, O.C. various Motor Transport Companies & Workshops; At present partner in firm, C. H. & P. H. Mitchell, Consltg. Engrs., Toronto.

References: C. H. Mitchell, W. A. Bucke, K. H. Smith, M. V. Sauer, J. B. Challies.

SMITH—ROY FOSTER, of Oakville, Ont. Born at Trenton, Ont., Oct. 31st, 1893; Educ., B.Sc., Queen's Univ., 1916; 1916, in charge of office of R. Waddell & Co., Toronto, Contractors; 1917-18, foreman acid maker, British Chemical Co., Trenton, Ont.; 1918 (Mar.-April), Dept. of Rys. & Canals, Toronto on Canadian Northern Arbitration; 1918-19, res. engr. in charge of the Tansley High Level Bridge., A. W. Connor, Toronto, Chief engr., Norman McLeod Ltd., Contractors; Jan. 1920 to date, res. engr. in charge of 16 mile creek bridge, township of Trafalgar, Ont., for Norman McLeod Ltd.

References: J. A. Bell, N. M. McLeod, A. W. Connor, G. Hogarth, F. A. Bell, F. B. Goedike.

STEERS—CONNELL GERALD, of Ottawa, Ont. Born at Ottawa, Ont., Aug. 23rd, 1893; Educ., Private study, 1898-1909; 1909-13, rodman & instr'man, N.T.C. Rly.; 1914-15, with D.P.W., Ottawa, as first asst. to engr. in charge and subsequently engr. in charge of rock excavation at the Big Chaudiere Dam, French River. Also 1st asst. on precise levels to close all B.M. between Rainy River and The Lake of the Woods; 1916-19, overseas, engr. officer with C.E.F. and Royal Engrs.; 1919 to date, asst. to Dist. Engr. S. J. Chapleau, D.P.W., Ottawa.

References: S. J. Chapleau, C. R. Coutlee, H. M. Davy, A. W. Gregory, D. W. Jamieson, C. Chaloner, A. St. Laurent.

THOMPSON—GEORGE WILLIAM, of Westmount, Que. Born at Belleville, Ont., Aug. 11th, 1877; 1898-99, Montreal Electric Co.; 1899-1902, wiring contracting business, Belleville, Ont.; 1902-04, Lachine Hydraulic & Land Co., asst. to constrn. supt.; 1904-06, asst. to constrn. supt., Montreal Light Heat & Power Co.; 1906-08, with City of Westmount under Messrs. Ross & Holgate during constrn. of electric light & incineration plants; 1908-13, carried on work of supt. of Westmount Light & Power Dept.; 1913-21, gen'l mgr. of City of Westmount and supt. of Westmount Light & Power Dept.

References: R. A. Ross, F. B. Brown, W. J. Francis, J. M. R. Fairbairn, J. Duchastel, P. E. Jarman, A. L. Harkness.

THOMPSON—NORMAN ALBERT, of Ottawa, Ont. Born at Kinnear's Mills, Que., July 31st, 1886; Educ., B.Sc., McGill Univ., 1912; 1908 (mos.), rly. location, C.P.R.; 1909 (4 mos.) rodman, rly. constrn., C.P.R.; 1910 (4 mos.), instr'man, rly. constrn., C.P.R.; 1911-12, topog'c asst., field and office, Geol. Survey of Canada; 1913, engr. on constrn. of foundation of Examing Warehouse, Montreal, for The Foundation Co. Ltd.; 1914, surveys examiner, Topog'l Surveys Branch, Dept. of the Interior; 1915-19, overseas, Capt., C.F.A.; 1920, asst. to chief of party, reclamation service; At present, junior engr., Reclamation Service, Dept. of the Interior, Ottawa.

References: R. J. Burley, J. S. Tempest, G. F. Horsey, G. F. Richan, H. R. Carm, J. K. Wyman, G. W. Shearer.

THOMPSON—TREVOR CREIGHTON, of Montreal, Que. Born at Toronto, Ont., July 4th, 1898; Educ., B.Sc., McGill Univ., 1920; 1916 (2½ mos.), Marconi operator, S. S. Cascapedia; 1918-19, Can. Tank Corps, England; 1920 (July & Aug.), elect'l repair dept., Laurentide Co., Grand Mere; 1920 (Sept.-Dec.), engr'g dept., Brompton Pulp & Paper Co., East Angus, Que.; Not employed at present.

Experiences: F. O. White, C. M. McKergow, F. H. Pitcher, L. A. Herdt, Sir John Kennedy.

TISDALL—FREDERICK, of Moncton, N.B. Born at London, England, Jan. 26th, 1890; Educ., I.C.S.; Hydro-Electric plant install'n., Can. Gen. Electric Co. & Westinghouse Co.; Mtce & repair, The T. Eaton Co. Ltd.; Charge of power stn. 110,000 volts, Hydro-Electric Comm'n., Guelph, Preston & Toronto; 12 years with The Eaton Co. Ltd., engr'g dept., At present chief engr., Moncton branch.

References: F. A. Gaby, J. Edington, J. D. McBeath, M. J. Murphy, C. L. Fellowes.

TILLETT—CHARLES HERMAN, of Montreal, Que. Born at Peru, Indiana, U.S.A., Dec. 8th, 1884; Educ., B.S. (C.E.), Purdue Univ., 1907; 3 years signal repairman, Penn. R.R. & Great Nor. Rly.; 3 years signal insp'r., Chicago & Eastern Illinois Ry.; 1913-18, supervisor of signals, G.T.R.; 1918 (6 mos.), elect'l engr., G.T.R.; 1918 to date, acting signal engr. & signal engr., G.T.R.

References: F. L. C. Bond, M. S, Blaiklock, A. S. Going, H. B. Stuart, J. A. Burnett, W. McNab, A. Crumpton, W. Walker.

TORRENS—GROVER CARLETON, of Moncton, N.B. Born at Fredericton, N.B., Dec. 22nd, 1884; Beach. in C.E., Univ. of N.B. 1906, Grad. in Reclamation Engr'g., A.S.C. 1913, Member Assn. of Prof. Engrs. of the Province of N.B.; 1903 & 04 (Summers), dftsman and instr'man, ch. engr's office, I.C.R., Moncton; 1904-05, instr'man with F. A. Barbour of Boston on water supply of town of St. Stephen, N.B.; 1906-09, in charge of constrn. of rly. shops, I.C.R., Moncton, N.B.; 1910-11, in charge of constrn. of 8½ miles new rly. near Chatham; 1912-14, asst. in office & field, ch. engr's staff, Moncton; 1915-16, in charge of constrn. of subway at Main St. East crossing of C. G. Rlys., Moncton; 1916, acting divn. engr., and 1917 to date, divn. engr., Moncton Divn., Eastern Lines, C.N.R.

References: C. B. Brown, W. A. Duff, J. Edington, W. B. MacKenzie, J. S. O'Dwyer, W. R. Devenish, F. B. Tapley, A. R. Dufresne.

TRIMBLE—ARTHUR VINCENT, of Toronto, Ont. Born at Trafalgar, Ont. Sept. 12th, 1878; Educ., B.A.Sc., Univ. of Toronto, 1905; 1903, in charge of survey party under W. H. Fairchild; 1904, acting county engr., Haldimand & Norfolk; 1905-07, general constrn. work, Imperial Constrn. Co.; 1908 to date with H. E. P. C. of Ontario as follows:—1908-10, res. engr., constrn. steel tower transmission lines, Niagara Falls to London; 1911, in charge of all transmission lines; 1912, obtaining stream flow data in Ontario rivers; 1913-17, engr. in charge of constrn., steel tower transmission lines including the electrification of the London & Port Stanley Rly.; 1917-21, engr. in charge of all constr. work, not including Chippawa Development or transmission lines; Since Jan. 1st, 1921, in charge all constrn. work, including transmission lines but not including Chippawa Development.

References: E. G. Hewson, J. R. W. Ambrose, H. G. Acres, L. I. Stone, T. H. Hogg.

TROTT—ALFRED, of Winnipeg, Man. Born at Bath, England, June 28th, 1881; Educ., Completed elect'l engr'g courses I.C.S. & A.S.C.; 1897, ap'ticed to Jno. Walker & Sons, Engrs. & Contractors, Cardiff; 1903-04, central station operator, Winnipeg Street Rly.; 1904-06, foreman on install'n hydro-electric plant for Winnipeg Street Rly. Employed by Can. General Electric Co.; 1906-08, central station (hydro) operator, British Columbia Electric; 1908-09, central station (hydro) operator, Cascade plant of West Kootenay Power & Light Co.; 1909-13, supt. & estimator for Mather Yuill & Co., Vancouver; 1913-16, asst. to dist. engr., attached to Vancouver office, Can. Westinghouse Co.; 1916-19, elect'l engr., Tonapah, Belmont Mining Co., Tonapah, Nevada. Design and install'n hydro-electric plant etc.; 1919-20, constrn. engr. in charge of elect'l install'n & design of substation, and 1920-21, elect'l engr. in charge of all elect'l work and equipment, Winnipeg Electric Rly. Co. Winnipeg; At present with Levy Electric Co., Winnipeg.

References: F. L. Butler, S. Wilkins, W. N. Smith, E. V. Caton.

WHITEHOUSE—LLOYD AMOR BLACHFORD, of Hamilton, Ont. Born at Hamilton, June 1st, 1896; Educ., 3 years course, elect'l., mech. design, Hamilton Technical School; 1915-19, with MacKay, MacKay & Webster (later MacKay, MacKay & Perrie), gen'l surveying & munic. work; 1919-20, Hamilton Harbour Comm'n.; 1920 to date, asst. to J. A. W. Brown, chief engr., W. H. Yates, Constrn. Co.

References: J. M. Wilson, J. A. Brown, A. R. MacPherson, E. R. Gray, E. H. Darling, W. B. Ford, F. W. Paulin.

WHITMAN—AUBREY HUME, of Halifax, N.S. Born at Lawrencetown, N.S., Nov. 9th, 1894; Educ., Diploma, Applied Science, Acadia Univ., 1914; 3rd & 4th years of elect'l engr'g., Nova Scotia Tech. College; 1916 (summer), with N.S. Tramway & Power Co., Halifax, N.S.; 1917-18, instructor, Commercial Cable Co's employees, Canso, N.S.; 1919-20, Re-Education Principal, D.S.C.R. of Nfld.; 1920 (Feb.-Sept.), instructor in electric & gas engines, N.B. Vocational Education Board; At present, instructor elect'l engr'g., N.S. Tech. College.

References: F. R. Faulkner, J. F. Lumsden, W. G. Hardy, J. W. Morris, R. R. Murray, F. A. Bowman, R. P. Freeman, F. H. Palmer.

WILKES—JOHN WILLIAM HENRY, of Calgary, Alta. Born at London, England, 1890; Educ., Rossall College, England, 1905-06; 1911, on D. L. surveys; 1912-13, rodman & leveller, C.P.R., D.N.R., location & constrn. irrig. system; 1914 (May-Aug.), leveller, irrig. office, Dept. of the Interior, Calgary; 1914-19, overseas; 1910 (May-July), instr'man, irrig. office, Dept. of the Interior; July 1920 to date, hydrometric recorder, asst. dist. engr., Water Powers Branch, Dept. of the Interior, Calgary.

References: G. N. Houston, A. L. Ford, G. H. Whyte, F. K. Beach, A. W. P. Lowrie.

WOOD—GEORGE HOWARD, of Ottawa, Ont. Born at Kincardine, Ont., May 12th, 1896; Educ., B.A.Sc., Univ. of Toronto, 1917; 1914-15 (summers), junior asst. engr. to G. G. McEwen, field staff, Dominion Water Branch; 1916 (summer), first asst. to G. G. McEwen; 1917-19, overseas, temp. Lieut., Can. Engrs.; 1919-20, junior power development engr., Dominion Water Power Branch; May 1920 to date, asst. hydraulic engr., reclamation service, Dept. of the Interior, Ottawa.

References: R. J. Burley, J. T. Johnston, H. R. Cram, T. H. Dunn, J. S. Tempest, G. F. Horsey, G. G. McEwen, C. H. Attwood.

WOODBURN—ASHLEY, of Toronto, Ont. Born at Dafna Villa, Dumfries, Scotland, Jan. 30th, 1882; Educ., Heriot Watt College, Edinburgh; 6 years mech. & struct'l design, Scotland; 1909-12, city architect's dept., Toronto. Engr. examiner of plans for reinforced concrete, struct'l steel & gen. bldg.; 1912-15, private practice, Hunt & Woodburn, Arch'ts & Struct'l Engrs., Toronto; 1916, asst. designing engr., Toronto Harbor Comm'n.; 1917, engr. dftsman in charge of all engr'g design, British American Nickle Corpn., Sudbury, Ont.; 1918 to date, sales engr., The James Morrison Brass Mfg. Co. Ltd., Toronto.

References: W. E. M. Bonn, J. C. N. B. Krumm, I. F. Willsie, N. D. Wilson, J. G. R. Wainwright, W. A. M. Cook, E. L. Cousins.

WOOTON—FRANCIS EDWARD, of Saskatoon, Sask. Born at Niagara-on-the-Lake, Ont., Jan. 19th, 1886; Educ., Final year, civil engr'g., Univ. of Sask.; 1 yr. on surveys, 4 yrs. on constrn., C.P.R.; 5 yrs. overseas, Capt., Awarded M.C.; 6 mos. acting trainsmaster, C.P.R.

References: W. A. Mather, J. R. C. Macredie, A. R. Greig, C. J. Mackenzie, J. E. Underwood, E. E. Brydone-Jack.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

DALZELL—ARTHUR GEORGE, of Toronto, Ont. Born at Utakamund, India, April 24th, 1869; Kingswood College, Bath, England, Member, Royal Sanitary Institute, Great Britain, (by exam.); 1886-90, articled pupil. Middlesborough, England; 1891-93, asst., Halifax, England; 1894-97, private practice, Halifax, England; 1908-18, asst. city engr., Vancouver, B.C.; 1919, asst. to town planning advisor, Dom. Govt., Ottawa; 1920, private practice, Vancouver; At present Consltg. Engr. for Clay Products Agency Ltd., Toronto.

References: C. Brakenridge, H. M. Burwell, W. H. Powell, F. P. Wilson, E. A. Cleveland, F. S. Keith.

GIROUARD—RENE ARTHUR DE LA BRUERE, of Matawa, Ont. Born at Quebec, Que., Jan. 29th, 1882; Educ., Ridley College, St. Catharines, Ont. Received Comm'n in regular Army, 1899; Served 3 years in 3rd Royal Can. Regt., Halifax; 1904-05, rodman, mtce. of way, C.P.R., Nelson, B.C.; 1905-08, topog'r. leveller, transitman, T. C. Ry.; 1908-10, rees ngr., T.C. Ry., constrn., La Tuque, Que.; 1910-11, asst. to res. engr., mtce of way, C.P.R. Brownville Jct., Me., U.S.A.; 1911-12, consltg. civil & mining engr's firm of Gaul & Girouard, Toronto; 1912-14, engr. in charge of grade revisions and constrn., Soo Branch, C.P.R.; 1914-19, overseas, Enlisted as Lieut. 22nd Bn. Demobilized as Lt.-Col.; 1919-20, asst. supt., Havelock divn. and Sudbury divn., C.P.R.; July 1920 to date, Progress Engr., Riordon Co. Ltd., under G. L. Freeman, mgr. of engineering in the constrn. of 500 ton sulphite pulp mill at Temiskaming, Que.

References: G. L. Freeman, J. M. R. Fairbairn, C. T. DeLamere, C. W. P. Ramsey, G. Grant, A. E. Doucet.

MUIR—ROBERT CRAWFORD, of Toronto, Ont. Born at Ayr, Scotland, Sept. 11th, 1884; Educ., Grad. Glasgow & West of Scotland Engr'g College 1906. Assoc. Member, Munic. & County Engrs. Inst. of Great Britain, 1915; 1900-03, articled to city engr. of Ayr Scotland; 1906-09, asst. to city engr., Stirling, Scotland; 1909-12, deputy city engr., Stirling; 1912-14, asst. engr. & dftsman, C.N.R.; 1914-19, munic. consltg. engr., Dept. of Public Highways, Province of Ontario; 1919 to date, chief engr. of county roads, Province of Ontario.

References: W. A. McLean, W. P. Near, A. M. Jackson, R. O. Wynne-Roberts, E. A. James, F. Barber, M. U. Ferguson, A. K. Hay.

OXLEY—JAMES MORROW, of Toronto, Ont. Born at Halifax, N.S., Sept 12th, 1883; Educ., 1 year Applied Science, Univ. of Toronto. Study of struct'l engr'g for past 20 yrs.; 1899-1902, dftsman, Dominion Bridge Co.; 1902-04, dftsman, Canada Foundry Co.; 1905, dftsman, C.P.R.; 1905-06, asst. engr. on constrn. of Aberdeen Elevator at Midland, Ont.; 1906-07, checker, Canada Foundry Co.; 1907-09, member of firm Oxley & Chadwick, Toronto, struct'l design; 1909-11, ch. engr. in charge of designing & dfting office, McGregor & McIntyre, Ltd., Struct'l Steel Works, Toronto; 1911-15, member of firm Harkness & Oxley, Toronto, consultants & architects on struct'l design; 1915-19, overseas, Major, Can. Engrs.; Jan. 1919 to date, member of firm, Chapman, Oxley & Bishop, Architects & Engrs., Member, Canadian Engineering Standards Assn., Appointed to Committee on Cement & Concrete.

References: R. O. Wynne-Roberts, C. R. Young, E. L. Cousins, H. M. Lamb, R. E. Chadwick, G. T. Clark, J. B. Carswell.

SMITH—J WARREN, of Toronto, Ont. Born at Philadelphia, Pa., U.S.A., April 21st, 1885; Educ., Franklin Inst. night school, Phila., Corres. school, night classes, home study, 1899 to date; After 6 yrs. office and 3 yrs. shop work entered drawing room of American Bridge Co., Ambridge, Pa., in 1908; 1910-12, drawing room, Canada Foundry, Toronto; 1913-21, Dominion Bridge Co., Toronto, 1914-16, ch. dftsman, 1917-21 engr. Also mgr., Toronto office, Robb Engr'g Works.

References: G. H. Duggan, F. P. Shearwood, D. W. Robb, G. E. Evans, J. W. Moffat, E. S. Mattice, C. S. G. Rogers, R. S. Buck.

STEAD—GEOFFREY, of Chatham, N.B. Born at Brooklyn, N.Y., July 12th, 1872; Educ., B.A. & Diploma in C.E., Univ. of N.B., 1892; 1892-1900, asst. engr. & engr. in charge of surveys & constrn on various rlys. & municipal works in New Brunswick, Nova Scotia & U.S.A.; 1900, asst. engr. D.P.W., Canada; 1904, engr. in charge, Dept. of Public Works Canada, Northern & Eastern Districts of New Brunswick; 1904-21 district engr., same territory.

References: E. D. Lafleur, K. M. Cameron, E. T. P. Shewen, H. J. Lamb, C. E. W. Dodwell, C. C. Kirby, G. G. Hare.

FOR TRANSFER FROM CLASS OF ASSOCIATE TO HIGHER GRADE

YORK—JOHN JAMES, of Montreal, Que. Born at Lacadie, Que., June 12th, 1861; Member, Amer. Soc. Mech. Engrs., 1911; 6 yrs. ap'ticeship, heating & ventilation; 1881-85, engr'g dept., St. Lawrence Sugar Refineries; 1886-92, asst. to chief engr., charge of erection of all bldgs. & machinery; 1893-95, in charge of contracts for Garth Co.; 1896-99, supt., Montreal Board of Trade Bldg.; 1900, appointed chief engr., St. Lawrence Sugar Refinery Co., with full charge of design and erection of all bldgs., plant & machinery. At present, gen'l works mgr., of above company.

References: S. F. Rutherford, K. B. Thornton, J. H. Hunter, J. T. Farmer, E. S. Mattice, F. B. Brown, J. L. Busfield, R. M. Wilson.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

BEWS—DOUGLAS WALDRON, of Port Hope, Ont. Born at Gananoque, Ont., Feb. 5th, 1892; Educ., B.Sc., Queen's Univ., 1914; 1911, O.L.S.; 1912, rodman, T.C.Ry.; 1914-15, dftsman & instr'man, C.R.C.E., M.D. No. 3, Kingston; 1916-19, overseas, officer, Royal Engrs.; 1919 to date, res. engr., Dept. of Public Highways of Ontario.

References: W. A. McLean, G. Hogarth, J. G. Cameron, A. W. Gray, H. S. Dick.

BUCKMAN—ADDISON W., of Kemptville, Ont. Born at Ogdensburg, N.Y., Feb. 9th, 1890; Educ., 1 year Science, McGill Univ.; 1909 (summer), constrn. & equipment power house, Ottawa Electric Co.; 1910 surveys, Municipal Electric Co., Ottawa; 1911, levelman, surveys & filtration scheme, City of Ottawa; 1911-13, dftsman, city engr's office, Ottawa; 1913-16, asst. to sewer engr., City of Ottawa; 1916-17, design of chart system to show progress & supply of contracts, Imperial Munitions Board; 1917-19, insp'r., gauges & standards, Imperial Munitions Board; 1919 (apr.-July), office engr. with Alex. I. Garnock, Contractor, Ottawa, constrn. of Ottawa Technical School; 1919-20, ass. tengr., Ottawa-Prescott Highway; March 1920 to date, asst. to engr. in charge, Ottawa-Prescott Highway, in charge of constrn.

References: W. F. M. Bryce, A. K. Hay, F. C. Askwith, R. J. Durley, K. R. Ayer, D. Wyand, B. E. Norrish.

DOUGLAS—GEORGE VIBERT, of Westmount, Que. Born at Montreal, July 2nd, 1892; Educ., B.Sc., McGill Univ., 1920. Mining Fellowship, McGill Univ., 1920-21; 1912 (summer), G.T.R. shops; 1913 (summer), Skinner & Co., Gananoque, Ont.; 1915-19, overseas, Lieut. & Capt., North'l Fus., & Royal Engrs. Work consisted of trench constrn., mining & mined dugouts, light & standard gauge rlys., etc.; 1920 (summer), in charge of prospecting expedition sent out by Hudson Bay Co.

References: J. B. Porter, A. Stansfield, H. M. Mackay, E. Brown, C. M. McKergow.

FALLS—ORVILLE MERVON, of Toronto, Ont. Born at Wiarton, Ont., Feb. 24th, 1893, Educ., B.A.Sc. (Honours), Univ. of Toronto, 1914, Passed prelim. D.L.S. exam., 1912; Served 1 year under articles with O.L.S.; 1912 (6 mos.), instr'man, Algoma Central Rly.; 1913 (6 mos.), instr'man, C.N.R.; 1914 (4 mos.), res. engr. on constrn. of concrete road for town of Oakville, under J. A. Bell, M.E.I.C., St. Thomas, 1914-17, ch. insp'r of shells etc., and metal parts for aeroplanes for Can. Inspection Co., Imperial Ministry of Munitions, Can. Aeroplanes Ltd. & Curtiss Aeroplanes Ltd.; 1918 (6 mos.), dftsman & designer of concrete bridges, Toronto & York Roads Comm'n; 1918-19, res. engr. on munic. work, for E. A. James Co. Ltd., Consltg. Engrs.; 1919-20, estimating engr. in charge of design & constrn. of concrete sidewalks & asphalt pavements for Barber, Wynne-Roberts & Seymour, Consltg. Engrs., At present with same firm as engr. of constrn. for munic. improvements.

References: J. A. Bell, H. J. Lamb, C. R. Young, F. Barber, R. O. Wynne-Roberts, H. E. T. Haultain, H. L. Seymour.

LAFERME—LEOPOLD, of Montreal, Que. Born at Paris, France, March 6th, 1891; Educ., Matric., New College, England; 1908-11, pupil to Melleish & Harding, Land Surveyors, London, England, and at same time, private tuition from G. P. Knowles, A.M.E.I.C.; 1911-13, rodman, location & constrn., C.P.R.; 1913-14, instr'man, C.P.R. constrn.; 1914 (June-Dec.), instr'man, Town of Montreal West; 1915-17, insp'r., Imperial Ministry of Munitions; 1917-19, overseas, Can. Rly. Troops; 1919 (2 mos.), transitman, C.P.R.; Dec. 1919-Jan. 1920, engr. in charge of party for Anthes Foundry Co.; 1920, engr. in charge of party, G.T.R. Valuation. At present asst. engr., G.T.R. Valuation.

References: L. J. M. Howard, N. Campbell, F. Macarthur, W. Walker, H. Luscombe.

MONKMAN—GEORGE HUMPHREY NELSON, of Winnipeg, Man. Born at Winnipeg, Oct. 22nd, 1888; Educ., Evening classes, Y.M.C.A., Winnipeg, Man., 1909-10; 1904-08, rodman, instr'man & dftsman, C.P.R.; 1908-12, res. engr., C.P.R.; 1912-15, res. engr. on various bridges built by C.P.R. constrn. dept., Winnipeg; 1915-19, overseas, cpl., Rly. Constrn. Corps, Lieut. & Capt. Royal Engrs.; 1919 (Sept.-Oct.), res. engr., C.P.R.; 1919-20, locating engr., C.P.R.; April 1920 to date, res. engr., C.P.R. constrn.

References: J. G. Sullivan, W. A. James, J. Callaghan, C. Flint, J. R. C. Marcredie, C. L. Hervey, D. Hillman.

PATTERSON—HARRY W., of Windsor, Ont. Born at Merritton, Ont., Feb. 22nd, 1891; Educ., London Collegiate Institute, Munic. engr'g course, I.C.S.; 1906-07, on location surveys, Hydro-Electric Comm'n., with F. W. Farncomb, London; 1907-10, ap'ticeship to F. W. Farncomb, C.E., O.L.S.; 1910-11, in charge of party on levels, double tracking etc., C.P.R. London Divn.; 1911 (July-Dec.), instr'man & Topog'r for H. J. Haffner, Vancouver; 1912-13, in charge of underground constrn & pole line surveys, Detroit Edison Illuminating Co., Detroit; 1913 to 20, asst. engr. with Owen McKay, in charge of design & layout of munic. work. On Mr. McKay's death purchased business, also appointed engr. for Walkerville & Ford City & acting chief engr. for Essex Terminals.

References: C. R. McColl, L. T. Bray, J. B. C. Keith, O. Rolfson, F. C. McMath, F. H. Kester, M. E. Brian.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

HARRISON—RONALD, of Birch Cliff, Ont. Born at Toronto, Ont., Jan. 15th, 1897; Educ., B.A.Sc. (Honours), Univ. of Toronto, 1920; Lieut.'s Cert., C.O.T.C., Univ. of Toronto, 1916; 1915 (June-Sept.), Toronto Hbr. Comm'n.; 1916-18, overseas, Can. Engrs.; 1918 (May-Sept.), dftsman and checker, Can. Aeroplanes Ltd., Toronto; 1919 (June-Aug.), dftsman, H.E.P.C. of Ontario; April 1920 to date, dftsman, Hydraulic Dept., H.E.P.C. of Ontario, Toronto.

References: M. V. Sauer, J. J. Traill, W. Harland, L. L. Campbell, J. A. Knight.

LAFFOLEY—LAURENCE HERBERT, of Montreal, Que. Born at Montreal, March, 14th, 1894; Educ., B.Sc. (Civil), McGill Univ., 1916; 1912, timekpr., C.P.R. constrn.; 1913-14, dftsman, C.P.R. constrn.; 1915 (May-Aug.), material clerk & supt. of constrn., reinforced concrete warehouse, Montreal; 1916-18, overseas, instructor in mil. engr'g., Can. Engrs., England; 1918-19, demonstrator in mech. dfting, McGill Univ.; June 1919 to date, dftsman, engr'g dept., C.P.R.

References: J. M. R. Fairbairn, J. W. Orrock, C. T. DeLamere, J. E. Armstrong, P. B. Motley.

MACKENZIE—JOHN FRASER, of Campbellton, N.B. Born at Fort George, Scotland, April 10th, 1891; Educ., Central Foundation School, London, England, 1906-08. Private study; 1910 (summer), rodman, water supply survey, town of New Glasgow, N.S.; 1910-11, rodman, Dominion Iron & Steel Co., Sydney, N.S.; 1911-14, transitman, same company; 1914-16, transitman, C.N.R.; 1916-19, overseas, Lieut., C.F.A.; 1919 to date, instr'man, C.N.R.

References: R. H. Smith, N. K. Hall, R. D. Inness, R. J. S. Sly, W. R. Campbell.

McMULKIN—A. FRANK, of Ottawa, Ont. Born at St. John, N.B., Aug. 20th, 1888; Educ., one year Science, Mount Allison University; 1908-11, rodman on constrn., N.T.Ry.; 1911-13, dftsman., dist. office, N.T.Ry., St. John, N.B.; 1913-14, dftsman, head office, N.T. Ry., Ottawa; 1915-16, dftsman, city engr's office, St. John, N.B.; 1916-20, instr'man on constrn., Quebec & Saguenay Rly.; 1920 (May-Nov.), dftsman, Grand Trunk Arbitration, Montreal; At present dftsman., Dept. of Railways & Canals, Ottawa.

References: J. G. Grant, A. Dick, D. W. McLachlan, S. E. Oliver, C. O. Foss.

MYERS—HAROLD RAYMOND, of Stratford, Ont. Born at Stratford, Ont., Dec. 27th, 1899; Educ., 1 year Arts, 3 years Science, Queen's Univ., 1917-1921. Civil engr., I.C.S.; 1917 (summer), dftsman, Stratford Bridge & Iron Works & city engr's office; 1918 (summer), instr'man, G.T.R.; 1919-20 (summers), ch. asst. to city engr., Stratford; At present Student, 3rd year civil engr'g., Queen's University.

References: A. B. Manson, A. Macphail, W. P. Wilgar, W. L. Malcolm, W. Monds.

RANKIN—GARNET, of Toronto, Ont. Born at Perth, Ont., Dec. 7th, 1887; Educ., B.A.Sc., (Honours), Univ. of Toronto, 1915; 1910 (8 mos.), C.G.E. Co., transformers, Peterboro; 1911 (6 mos.), location, constrn., mtce., Ontario Govt. Rly.; 1912, asst. on diversions with Hugh Lumsden, C.P.R.; 1913 (5½ mos.), in charge of party mtce. work, C.P.R.; 1914 (6 mos.), prospecting; 1915, munitions, M.S.A.; 1916-19, Lieut., Can. Engrs.; At present, engr., City Architects Office, Toronto.

References: S. B. Clement, J. H. Cornish, T. R. Loudon, R. G. Lye, P. Gillespie.

STEPHENSON—GEORGE ELGIN, of Toronto, Ont. Born at Verna, Ont., June 3rd, 1894; Educ., B.A.Sc., Univ. of Toronto, 1920; 1914 (summer), rodman etc., Toronto-Hamilton Highway; Enlisted April 1916 in Can. Engrs., Sapper, N.C.O. and Comm'n'd Officer; Summer & fall of 1920, foreman and supt., Warren Paving Co.; At present asst. to T. D. Mylrea, consltg. engr.

References: L. M. Jones, C. R. Young, T. D. Mylrea, P. Gillespie, J. M. Gordon.

WAGNER—HAROLD WILFRED, of Toronto, Ont. Born at Toronto, Dec. 20th, 1887; Educ., B.A.Sc., Univ. of Toronto, 1914; 1914 (May-June), asst. to C. C. Johnson, engr. for Chipman & Power, Sudbury, Ont., and until Dec. 1914, insp'r on same works for Town of Sudbury; 1915-16, in office of operating dept., Toronto Hydro-Electric Co.; 1916 (Mar-Aug.), asst. to mtce. engr., G.T.R., London Divn.; 1916-20 (with exception of overseas service), with International Nickel Co., in charge of survey work and supt. on power house constrn. at High Falls; At present on engr'g. staff, H.E.P.C., Niagara Falls, Ont.

References: R. L. Hearn, R. P. Johnson, E. L. Pettingill, L. I. Stone, C. R. Murdock, A. C. D. Blanchard.

WILLIAMS—HOWARD J., of Augusta, Me., U.S.A. Born at Kingston, Ont., April 28th, 1895; Educ., B.Sc., Queen's Univ., 1917. Master of Science, Mass. Inst. of Technology, 1920; 1917 (apr.-Nov.), rodman & instr'man, power house constrn., Cedar Rapids Power Co., Que.; 1917-18; field dftsman., Chippawa-Queenston power Development; 1918 (Apr.-July), inspector on reinforced concrete arch bridge, and July 1918 to Sept. 1919, instr'man with charge of party on constrn. of Chippawa-Queenston Power Development at Niagara Falls; 1919-20, post graduate studies at Mass. Inst. of Tech.; June 1920 to date, asst. engr., Maine Water Power Comm'n., Augusta, Me.

References: T. S. Scott, A. C. D. Blanchard, G. H. Lowry, R. P. Johnson, W. P. Wilgar, L. W. Gill, W. B. Crombie.

WINDELER—HENRY STANTON, of Grand Falls, Nfld. Born at Canso, N. S., July 1891; Educ., B.Sc., McGill Univ., 1914; R.M.C., Kingston, 1908-11, 1911-12, hydrographic survey dept., Ottawa; 1913-14 (summers), instr'man, topog'l surveys, Militia Dept.; 1914-19, overseas, Nfld. Regt., and Imperial Machine Gun Corps, Major, M.C.; 1920 (Jan.-Oct.), asst. engr., constrn. dept., G.T.R., Montreal; Oct. 1920 to date, asst. to chief engr., Anglo-Newfoundland Development Co., Grand Falls, Nfld.

References: W. Scott, W. J. Stewart, E. Brown, F. W. Taylor-Bailey, W. Walker, H. M. MacKay.

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Control of Corrosion in Iron and Steel Pipes*

The causes of corrosion, external and internal, in iron and steel pipe mains with a summary of control methods.

F. N. Speller

Metallurgical Engineer, National Tube Company, Pittsburgh, Pa.

Paper Presented at the General Professional Meeting, Toronto, February 2nd, 1921.

Corrosion of Iron or Steel in General

While there is a vast difference in the amount of corrosion of iron and steel under different conditions, and it has been proven that the relative corrosion of these metals also varies decidedly with surrounding conditions, there are certain fundamental causes which underly all cases of corrosion which should be understood by all who are interested in this problem in any of its phases.

Every metal when placed in water is subjected to a fixed tendency to go into solution. This is wholly a matter of electro-chemical activity and varies to a definite extent with each metal. Thus the initial reaction in the process of corrosion is analogous to solution in acid, pure water being in effect a very weak acid. The acidity of the water depends on the concentration of the hydrogen ions which determines the initial speed of attack. As in all electro-chemical reactions, however, the initial speed of solution soon slows down as the numerous little electro-chemical couples which form over the surface of the metal become "polarized" due to the accumulation of hydrogen on their cathodic surfaces, ultimately stopping the solution of the metal. In the case of iron a small amount of the metal (less than 10 p.p.m.) is dissolved as ferrous hydrate which also has a decided retarding action on the solution of the metal. This, the first stage of the corrosion of iron, while essential, is not a serious matter if the reaction between water and iron can be stopped at this point. As a matter of fact this reaction cannot proceed unless in some way or other the hydrogen film protecting the metal is removed. This is usually brought about by means of something in the nature of a depolarizer, generally free oxygen, which also combines with ferrous hydrate forming insoluble ferric hydrate, commonly known as rust.

This, the second stage of corrosion, is thus caused by the oxidation of hydrogen and ferrous hydrate in solution by the free oxygen of the atmosphere. Oxygen is soluble in water at normal temperature to the extent of about ten parts by weight per million (7 c.c. per liter) and as water readily absorbs more oxygen when this element is used up, as in rusting under atmospheric conditions, it will be seen that under such conditions the reaction will continue until the metal has been destroyed, or the reaction may be brought to a stop at any time through exhaustion of the supply of available oxygen. The latter case is illustrated in any closed water system, as in the case of a metallic water pipe where the amount of free oxygen will be found to drop as the water travels from the inlet, so that if the pipe is long enough the corrosion will finally be reduced to a negligible amount.

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*Those who wish to go into further details of the mechanism of corrosion may consult a paper on Preservation of Hot Water Pipe by Speller and Knowland. Trans. American Society of Heating and Ventilating Engineers. Vol. 24 (1918) P. 217.

Water and oil lines suffer mainly from outside corrosion due to soil conditions, which resemble more nearly corrosion under water than atmospheric corrosion. Underground corrosion may be accelerated by the presence of certain salts or acids in the soil, and by the more ready access of free oxygen either by direct circulation of air or by means of underground waters which have become charged with oxygen and carbonic acid. The corrosive action is greatly increased by a rise in temperature and velocity of water within certain limits and by contact of the metal with any materials which tend to intensify galvanic action, such as cinder or certain kinds of mixed trench fill, or even the heavy mill scale formed in hot finishing of the pipe which has a strong tendency where firmly attached to localize corrosion and cause pitting. Rust once formed on the surface also has this effect to a somewhat lesser extent.

From this brief outline of the main factors which tend to influence corrosion it will be seen how important it is to keep all parts of the pipe from contact with wet soil or water thru the use of protective coatings of substantial thickness properly applied.

The influence of composition of the metal under most conditions does not seem to have much effect in itself, all other things being equal. Wrought iron, Bessemer Steel and Basic Open Hearth Steel pipe have been in service thirty years or more, the records of such lines showing failures in some places and practically no corrosion in other places, depending on soil conditions, drainage and other external factors. It is very difficult to make a strict comparison of two or more materials in a pipe line underground for the reason that the conditions are so variable, but it is significant that wrought iron forged couplings have up to the present generally been used on steel pipe and so far as we can learn from many cases examined no difference in the depth of the corrosion has been found although wrought iron couplings are hammer forged and consequently should have a better structure and be more resistant than the pipe on which less work is done. So far as the metal itself is concerned the factor of prime importance as affecting initial corrosion seems to be the surface finish, particularly the mill scale which is decidedly electro-negative to iron and, therefore, is a more or less powerful accelerator of corrosion.

Protection Against Exterior Corrosion

From the above it will be understood that the main object of protective coatings is to exclude water from contact with the metal.

Such coatings as are available at present are by their very nature easily damaged and thus rendered practically useless if subject to abrasion after being applied. No coating has yet been found which has any chance of protecting such a material as oil well casing. Most of what follows is, therefore, applicable mainly to line pipe or water pipe subjected to underground corrosion.

Before any coating is applied in the field all loose rust or scale should be removed and a thin priming coat applied to the clean dry surface after the line is put together and ready to be ditched. Where a priming coat is applied at the place of manufacture, which is preferable, the surface should be cleaned and freshened up before any further protective coating is applied in the field. The subsequent protection needed depends on conditions which should be determined by a careful survey of the nature of the soil and drainage of the territory in which the line is to be laid. Old oil lines which were originally laid without any more protection other than a simple coat of paint as a rule have not given serious trouble for more than 10 per cent of their length. Therefore, in the interest of economy it is obvious that the places which are likely to cause trouble should be located and a type of protection selected suitable for each locality. In well drained sand or clay soils a second coat of some reputable pipe compound may be all that is necessary, or perhaps one coat would be sufficient, but in wet marshy places, especially where the ground water is corrosive, a much more substantial waterproofing will be necessary. Wherever the ditch can be drained economically it will, of course, be of considerable advantage to do so.

The function of the priming coat is principally to afford a strong bond between the thicker protective coating and the metal and is essential where the subsequent coat is applied hot to the relatively cold metal. The priming coat may consist of coal tar or a pure asphalt dissolved in naptha or benzol to a thin consistency. It is of little protective value in itself as is true of paints in general underground. To be of any practical value where underground corrosion is known to occur a non-porous coating of substantial thickness is required. The coatings which have given the best service may be classified as:—

Bituminous Coating

Melted bituminous mixtures which can be safely heated to 350—400° F. with a melting point of about 140° F. may be applied in the field with suitable brushes operated by hand or mechanically. Sometimes a coating of this class is poured over the pipe, the surplus being caught in a strip of canvas about 30″ wide held by two men by which means the coating can be worked evenly over the underside of the pipe. In this way with some care and practice a coating of from 1/16″ to ¼″ thick may be applied without much variation in thickness. Where coatings are applied in this way the pipe should of course be dry and the temperature should preferably be above 60° Fah.

The well known dips applied at the works by manufacturers come under this heading. Conditions are more favourable for the application of these coatings at the mill but the manufacturer has to take into consideration the problem of transporting the pipe without injury and is limited as to the coating material by this consideration. Most pipe has to stand a wide range of temperature fluctuation en route to destination, often as much as 100° F. If the temperature drops below the brittle point the coating is liable to crack off and if the solar heat absorbed raises the temperature of the coating above the melting point the mixture runs, in addition to which there is always a certain amount of damage due to abrasion in handling; all this necessitates careful inspection and attention to repairs. Coal tar pitch when properly refined makes one of the best preservative coatings but unfortunately the range between the brittle and melting points of this material rarely exceeds 45° F. so that an asphalt blend must be used in most cases where the pipe has to be shipped any distance after coating. Some of the asphalt mixtures which have been developed for this purpose have a temperature range (brittle point to melting point) of 120 or 130° F. and have proven quite satisfactory in service. The absorbtion of solar heat may be limited considerably by dusting the surface of the pipe with portland cement or fine white sand. A coating of whitewash applied over the sanded surface has been tried and was found to keep the temperature of the coating down to atmospheric temperature under a July sun.

Fabric Coating

Under some conditions the coating above described may be reinforced with advantage by a strip of fabric 6″ or 8″ wide wound spirally around the pipe while the coating is hot. This is easily done at the mill after the pipe has received the dip coat, by means of a machine designed for the purpose (Fig. 1). The fabric should be dried in vacuum and saturated by passing through a small tank of the asphaltic mixture as it passes on to the pipe. Naturally it is possible to make a better job with this type of coating in the mills while the pipe is clean and dry. With pipe 12″ and smaller, a saturated fabric in rolls of suitable size would be convenient for this purpose in the field, such as a large size electric tape, or the fabric may be saturated after application by a final coat of thin consistency. This method of protection has been used for some years and has become standard with one American manufacturer of bell and spigot steel water pipe, it having been found to give good service.

Heavy Bituminous Coating

Where the ditch is wet most of the time, especially where stray electric currents are likely to occur in the vicinity of the pipe, provision should be made to keep these stray currents off the pipe by the use of insulated joints or other means.* The pipe should then be boxed in as indicated in Figure 2 after being cleaned and having received the usual priming coat. The pipe is supported underneath every 10 feet or so on some non-porous insulating material such as a piece of hard burned sewer pipe or heavy glass about ¾″ thick. An asphaltic compound such as Parolyte or some similar mixture with a melting point of about 150° F. which has been heated so as to run readily is poured in between the pipe and the box on one side. Particular care should be taken that the asphalt passes underneath the pipe without leaving air pockets which would of course leave an opening for water to penetrate the coating. This coating has been found to be very effective both against corrosion and electrolysis when applied uniformly and not less than ¾″ thick. When the sides of the trench are stable, the side boards may be removed and the fill tamped in around the coating, however, it is better as a rule, to leave the box undisturbed. This coating together with insulated joints affords good protection against electrolysis.

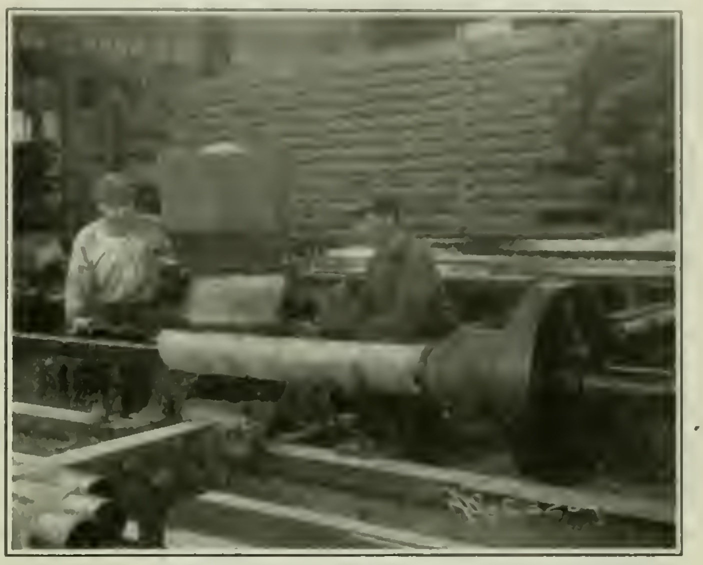

Figure 1.

Machine for Winding Fabric on Pipe.

Concrete Coating

Where corrosive conditions are severe as in marshy places where the water is brackish or acid, a covering of concrete has proved to give the best protection. A mix of 3 of sand to 1 portland cement thoroughly mixed together should be poured between the pipe and the box as in the case of the bituminous coating (see Figure 2). The pipe should be centred in the box and supported on non-porous material at suitable intervals so that the coating will not be less than 2″ in thickness for 8 or 12″ line pipe. No priming coat is required but the surface of the pipe should be well cleaned to remove all loose scale and dirt. The concrete should be moist enough to flow readily and should finally be formed up over the top of the pipe to the required thickness.

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*We do not have space to more than mention electrolysis in connection with this subject but it is expected that the reader will soon be able to get some practical and up-to-date information on this subject in the final report of the American Committee on Electrolysis which will soon appear under the auspices of the American Institute of Electrical Engineers.

The same precautions should be taken as described above with heavy bituminous coatings to avoid air pockets with careful inspection, to avoid leaving any uncoated places.

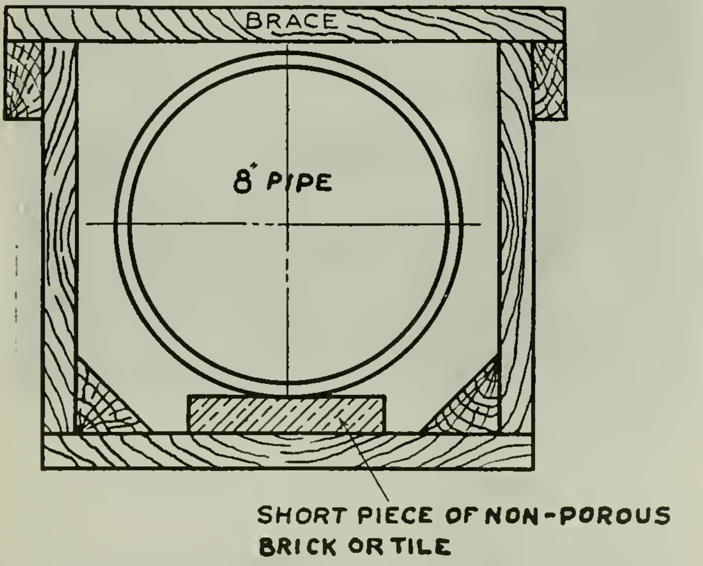

Figure 2.

Section of Wooden Form used for Application of Asphalt or Concrete Coating.

Thorough mixing of the sand and cement ensures a water-proof concrete and is better than to depend on introducing some water-proofing compound into the mixture. The side boards may be removed and re-used. If this is done a coating of asphalt should be applied to the sides of the concrete before filling in the ditch. A coat of hot asphalt should be applied to the bottom and sides of the box before the pipe is put into place.

Forms made of thin corrugated steel sheets have been tried and could probably be developed into a convenient and economical device where lumber is scarce. Oil lines protected in this way in brackish water have been free from corrosion for 25 years near the New Jersey coast. Precautions must be taken to guard against or repair cracking from expansion or contraction, or settlement.

Concrete coatings are not proof against electrolysis.

The above includes what is believed to be the best type of coating of each class altho each situation will present problems of its own requiring special treatment as to details.

Internal Corrosion of Water Pipe

The corrosion to which iron or steel pipes are subjected from contact with the water on the inside is not so serious as external corrosion; on the other hand it is somewhat more difficult to protect against.

The principle factors which determine the rate and character of internal corrosion and pitting are:—

1. Composition and finish of the metal.
2. Composition, temperature and rate of flow of the water.

As in the case of External Corrosion the composition of the metal does not seem to have any marked influence on the character or amount of corrosion. Internal corrosion of cold water pipes is usually so slow as to be negligible, although in some localities this is not the case. However, the rate of corrosion is usually so slow as to be difficult to determine with cold water, but when the water is heated under pressure the corrosive action is so much accelerated as to make it practicable to compare different materials in the same line and get trustworthy results in a year or two.

It has often been noticed that internal pitting is much deeper near mill scale where the scale is thick and firmly attached. The reason for this is undoubtedly due to the electro-negative character of the scale with respect to iron. Old rust acts somewhat in the same way, but is much less harmful. When the mill scale and rust are removed the tendency to pitting is greatly reduced provided the metal itself is fairly homogeneous and free from strains. It has been clearly demonstrated experimentally that surface finish is much more of a controlling factor in corrosion than any variation in composition of the metal in itself which is likely to occur, the explanation of this fact being that the external differences of potential due to mill scale and other extraneous matter is much greater than that due to segregation or other irregularities in the metal.

Corrosion varies directly with the temperature and rate of flow within certain limits and also with the composition of the water:—The higher the velocity, the more rapid is corrosion likely to be on unprotected metal.

There is a wide difference in the rate of corrosion with different domestic waters at normal temperature. Take for example Great Lakes water in comparison with the water supply of most of the New England cities and New York City. An interesting and useful example of corrosion greatly accelerated due to the magnesium salts in the water, is that of the 30" steel main to the Coologardie Mining District, Western Australia. The history of this line was given in detail in a paper by O'Brien and Parr before the Institute of Civil Engineers (Proceedings of the Institution, Vol. ccv., part 1, 1917-18. A few years after this pipe line was put into use serious corrosion was found both inside and outside. The deepest inside pitting was within a few inches of the lockbar seam where the mill scale had not been broken off in bending the plate. The authors of this paper are of the opinion that had this scale been removed before coating, pitting would not have occurred or would have been greatly limited. The cause of corrosion and means of prevention were investigated by Sir Alexander Binnie, Sons and Deacon, Sir William Ramsay, and Otto Hehner, who in their joint report, Sept. 30, 1909, recommended that three grains of lime per gallon be added to the water, that the water be de-aerated, and that precautions be taken to prevent reabsorption of air. The lime treatment was tried first but resulted in a considerable increase in thickness of scale on the interior walls of the pipe. The effect of the lime treatment on corrosion of this pipe according to the above report was rather inconclusive and disappointing. De-aerating was then tried. The reports after two years service are decidedly favourable, confirming the theory stated in the first part of this paper which has now been generally accepted, that corrosion is due primarily to the dissolved oxygen in water. The water is sprayed into a chamber under about 28″ vacuum by which 90% of the gases are removed and corrosion thereby reduced to one-quarter or one-fifth of the original amount.

It is much easier to study the various factors which influence corrosion in a closed system where all conditions are under better control. Early experiments made in 1907 pointed to the great influence which the dissolved oxygen has on corrosion. Careful laboratory experiments by Dr W. H. Walker and ourselves covering a period of several years have demonstrated that the amount of corrosion is almost directly proportional to the oxygen in solution, and also varies directly as the temperature. The predominating influence of free oxygen in water was suspected before this as a result of the early study of internal pipe corrosion by our Research Department, for the most striking fact in practical experience with piping in buildings was that hot water heating systems invariably showed no corrosion to speak of after 35 or 40 years use whereas frequently hot water supply systems operating at the same average temperature with the same water lasted only 6 or 8 years, the only difference being that the former carried no oxygen while the water on entering the latter was usually saturated with oxygen.

Protection Against Internal Corrosion

From the foregoing it will be seen that in addition to the use of protective coatings, under some conditions it is more economical to prevent internal corrosion by removing the dissolved oxygen from water. In fact, experience has shown that with hot water the latter method is much more effective and economical in the long run.

In practice the removal of oxygen from water has been accomplished in two ways:

1. By mechanical de-aeration for which there are two or three designs of apparatus in use giving satisfactory results.
2. The oxygen may be removed by chemical combination with some material such as scrap sheet iron.

Both the mechanical and chemical methods may be combined by using mechanical de-aeration to remove the larger portion of oxygen and the chemical treatment for the residual oxygen. Considerable has been written on this subject during the last few years with reference to the control of corrosion in hot water supply systems to which these interested may refer.* The most economical plan for any particular case depends very largely on local conditions.

The control of corrosion in condensers, especially where salt water is used, may be accomplished by de-aeration and there are probably many other cases where this principle can be applied economically to engineering practice.

For the internal protection of water mains by coating the metal, under most conditions a dip in a bath of well refined asphalt or coal tar will be sufficient. Again the importance of thorough cleaning and the removal of all scale from the steel, so far as practicable, should be emphasized. Where the coating is applied in the field a priming coat similar to that described for outside protection is necessary. Where the pipe is exposed to the weather for some time before laying it is best to apply these coatings in the field just before laying the pipe in the ditch, as otherwise the variation in temperature and handling will tend to injure the coating. In any case at least a priming coat should be applied to the clean surface at the mill.

Concrete has been used to a limited extent for the protection of the inside of pipes from one inch to eleven feet in diameter. Small service pipes have been used for thirty years in New England with an internal coating of 1/8″ of neat cement applied by means of some simple appliances designed for the purpose. This coating has also shown great durability as a lining for steel or wrought iron pipe carrying mine water and when properly applied to the clean surface, about ¾″ in thickness, is difficult to break off or injure unless there is considerable variation in temperature.

The 11 foot diameter steel pipe sections of the Catskill Aqueduct, were lined with two inches of portland cement grout. The plates of which this pipe was made were first pickled free from scale and given a coat of white-wash to prevent rusting. The outside of the pipe was protected by a coat 1-3-5 concrete mixture 4″ thick at the top. The reports from this line, which was put into service in 1915, indicate that this coating has been satisfactory so far as can be ascertained at present. It is interesting to find that the carrying capacity of the cement lined Catskill conduits is greater than in the unlined pipe under these conditions notwithstanding the reduction in diameter of the lined pipe.

What has been written above necessarily deals in general principles. The details of the application of these principles to practice in various cases will of course require variation to suit local conditions. Considering the great economical importance of conservation of material in our day, it would seem that the boundaries of engineering practice should be broadened out a little so as to include more of Anti-Corrosion Engineering.

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*Paper by J. R. McDermet on The Separation of Dissolved Gases from Water and Discussion A.S.M.E. meeting St. Louis, May, 1920.

*Papers by F. N. Speller, W. H. Walker and R. G. Knowland, Transactions A.S.H. & V. Engrs., 1918 and 1920.

Relay Protective Features of The Toronto Power Company's Transmission and Distribution System

The problem of protecting the Toronto-Niagara system of the Toronto Power Company, results with Time Limit Protection, Parallel Feeder Protection, Double Line Protection, and the Ground Selector; the paper concludes with details of design for the various methods of protection mentioned above.

P. Ackerman

Advance Proof of Paper to be read before Montreal Branch, The Engineering Institute of Canada, April 14th, 1921.

Introduction

A protective system is in such close relationship to and dependency upon the layout of an electric transmission system, its operating conditions and character of load, that the characteristics and advantages of a new protective scheme will be fully appreciated only when a technical description of the scheme is combined with a description of the operating difficulties and circumstances which call for the creation of the protective features.

Only comprehensive information of this sort will permit proper judgment being formed as to the adaptability of the scheme to other systems under similar circumstances.

In view of the above consideration the writer decided to present the various protective features developed and installed on the Toronto Power Company's system, by outlining in a general paper the operating conditions of the system and the history of the development of the protective system, including operating results, and by describing the technical details of the various schemes in the second section of paper.

1. Description of the System and Operating Results of the Various Protective Schemes

Figure 1 shows schematically the layout of the system as existing from 1913 to 1918, the period during which the relay schemes, hereafter described, were developed and subsequently put in service.

In 1918 two of the transmission lines were changed from 60,000 volt to 90,000 volt operation, thus permitting the dismantling of the other two lines for other use. Present operating conditions existing since 1918, are represented in the schematic diagram (Figure 2) so far as the transmission system is concerned.

The 12,000 V. distribution of Toronto has always been, and is still, the same as represented in Figure 1.

The Toronto main distribution is characteristic in the arrangement of each sub-station being fed by 3 or 4 parallel cables. Besides these feeders there are a few independent radial feeders emanating from the terminal station or from some of the sub-stations.

The Toronto load consists of about 50% to 60% synchronous load, partly synchronous motors and partly rotaries for the Street Railway Co. The synchronous motors are of the old style having very low reactance and none of the refinements of the modern synchronous motor, and as a result are very sensitive to voltage disturbances. The rotary converters are still more sensitive. Almost 60% of the load therefore is very sensitive to short circuit disturbances.

Another feature of the system which gave cause for worries as to relay protection is a steam turbine station in Toronto, which originally was a standby station, but which gradually was made use of as a peak load carrier thus permitting almost a 100% load factor on the hydraulic station.

The old 60,000 V. transmission system was delta non-grounded, but this was changed to star, solidly grounded at both ends of the lines when the voltage was changed to 90,000.

The 12,000 V. Toronto distribution is delta non-grounded. The largest part is underground distribution; some of the feeders, however, are long overhead lines.

Historic Development of the Relay System

Up to 1912 no special attention had been given to relay protection. All feeders and lines had overload relays of the bellow type. The relays were all set according to the judgment of the local station operators with the results to be expected.

Toward the end of 1912 a careful study of the system was begun. It was realized that the whole system had to be considered as one inseparable unit and that each protective device had to be in proper relation to the whole system.

Time Limit Protection

The first step of improvement carried out was the installation of an adequate selective Time Limit Protection to insure discriminative clearance of distant feeders without causing main lines to open simultaneously.

The faults of improper time curve, inaccuracy and unreliability of the relays, then used, were realized and after careful laboratory tests the Condit type "A" relay was adopted as the only relay, in those days, which combined accuracy and reliability with a time curve having practically definite time characteristics under the heaviest short circuit conditions. These relays were set and installed as shown in Figure 1.

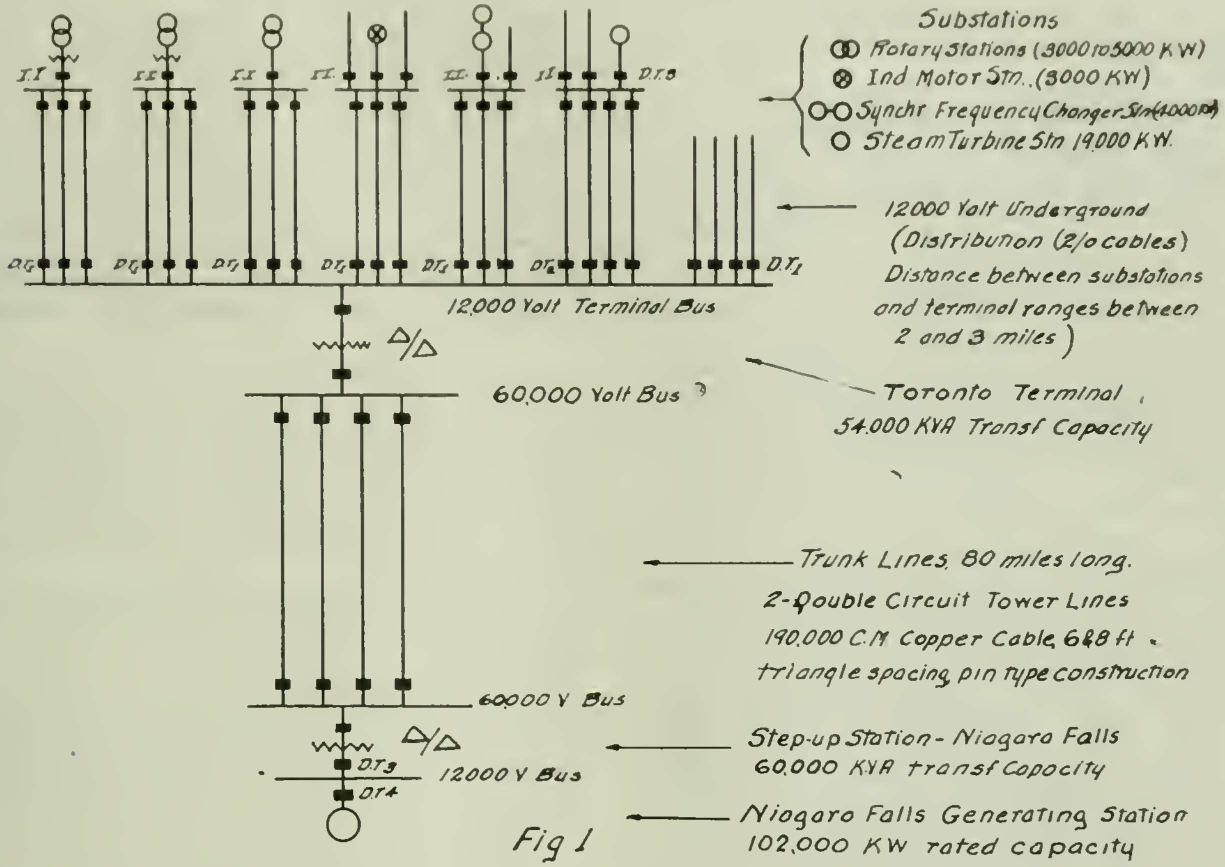

Substations
Rotary Stations (3000 to 5000 KW)
Ind Motor Stn. (3000 KW)
Synchr Frequency Changer Stn (4000 KW)
Steam Turbine Stn 19.000 KW.
D.T.8
D.T.1
12000 Volt Underground (Distribution (2/o cables) Distance between substations and terminal ranges between 2 and 3 miles)
12.000 Volt Terminal Bus
Δ/Δ
60.000 Volt Bus
Toronto Terminal 54.000 KVA Transf Capacity
Trunk Lines, 80 miles long.
2-Double Circuit Tower Lines
190.000 C.M Copper Cable, 6&8 ft triangle spacing, pin type construction
60.000 V Bus
Δ/Δ
D.T.3
D.T.4
12000 V Bus
Step-up Station - Niagara Falls 60.000 KVA transf Capacity
Niagara Falls Generating Station 102.000 KW rated capacity

Fig 1

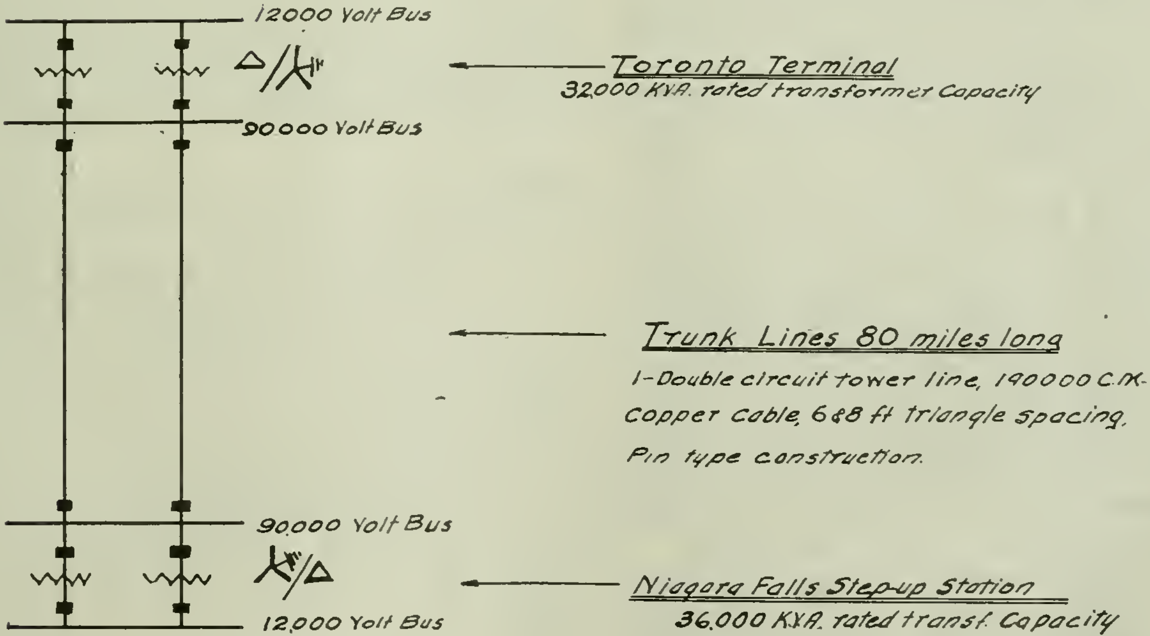

12000 Volt Bus
Toronto Terminal
32.000 KVA. rated transformer Capacity
90000 Volt Bus
Trunk Lines 80 miles long
1-Double circuit tower line, 190000 C.M. copper cable, 6&8 ft triangle spacing. Pin type construction.
90.000 Volt Bus
Niagara Falls Step-up Station
36.000 KVA. rated transf. Capacity
12.000 Volt Bus

FIG. 2

The machines and feeders at the sub-stations were left protected with the old bellow type relays having very light time settings, giving an inverse instantaneous time curve. (I. I.)

All terminal feeders were equipped with the new definite time relay (D. T.) with setting (1) equal to approximately ½ second. The steam station feeders were equipped with definite time relays (D. T. 2) where index (2) denotes a setting approximately ½ second higher than relays with index (1). The higher setting was necessary to insure that sub-station feeders would open on (D. T. 1) before the steam station feeders with (D. T. 2) would have time to open. Steam turbines were equipped with D. T. 3 to be selective with the station feeders of setting D. T. 2. At the generating station the transformers were equipped with definite time relays D. T. 3 to be selective with the steam station feeders (D. T. 2) and finally the generators were set at D. T. 4 to be selective with the transformer relays D. T. 3.

Simultaneously with this improved selective Time Protection, a discriminating current balance protection was proposed for all sub-station feeders with 3 and 4 cables in parallel. The scheme, however, was considered too novel for general adoption and it was also felt at that time that sufficient discrimination was obtained with the Time Limit Protection, accepting, in case of a sub-station cable short, a complete shut down to the respective sub-station in expectation that the rest of the system would remain undisturbed. It was decided, however, to give the proposed Parallel Feeder Protection a trial on the 4 feeder group connecting the terminal with the steam station. The principal of this protection is described in the second section of the paper

The new time limit relays were installed during 1913 and have proved fully up to expectations as far as selective action of switches in series is concerned.

However, there soon developed very unpleasant disturbances of a secondary nature whenever a serious system short was cleared by a relay having a setting of ½ second or longer.

In every such case practically all synchronous load was lost; the steam turbines usually were cut out on the steam end by the overspeed cut out; sometimes the terminal feeders of the steam station opened up on overload due to the excessive exchange current rush between hydraulic and steam station and often a single phase short had sufficient time to develop into a three phase short, thus causing also the loss of induction motor load tripping on no-voltage release.

Any such occurrence, therefore, paralyzed practically the whole system and the only advantage gained compared with a complete shut down was the fact that the system stayed alive and was ready for immediate resumption of service.

Through these experiences it was realized that, although the relays performed their duty correctly, the principle of time limit protection could never be expected to give full satisfaction for the system in question by reason of the sensitiveness of the load.

It was reasoned that apparently a short of half second duration would allow the synchronous load and generating stations to drift apart sufficiently to cause an enormous exchange current and in the worst cases, a dropping out of step after voltage recovery. It was felt that instantaneous protection would prevent such trouble, leaving not enough time for the stations to drift apart. To verify this latter assumption some tests were made by clearing dead station bus shorts at the terminal, with instantaneous relay action. The results indicated that no synchronous load was dropped in case of single phase shorts, while in case of three phase shorts some of the synchronous load dropped off. These results showed clearly that no effective service improvement could be expected until instantaneous and selective protection would be obtained for the whole of the main system.

Parallel Feeder Protection

Meanwhile, the Parallel Feeder Protection had been installed on the four parallel feeders between terminal and steam stations. About six months after its installation it cleared a faulty cable. It performed its duty with hardly any disturbance to the system and without any load loss whatever.

This satisfactory result paved the way for the adoption of the principle on the 4-60,000 V. lines Niagara Falls-Toronto.

In 1916 a Parallel Feeder Protection was put in service on the above mentioned overhead lines. The scheme used was similar to the previous one but materially improved and various operating inconveniences of the former scheme removed. A detailed description of the scheme is given in another section of the paper.

This protection remained effectively in operation until 1918, when the four line 60,000 V. system was changed to a two line 90,000 V. system, with the result that the Parallel Feeder Protection became superfluous.

The following operating results give an idea of the satisfactory performance of this protection:—

Table I

Year	Single line shorts successfully cleared by the Parallel Feeder Protection without causing interruption.						Multi line shorts causing total interruption
	Lightning	Sleet & wind	Insl. failures	Misc. outside interference	Unknown causes	Total	Outside Interference
1916	7	3	13	–	1	24	—
1917	—	—	6	1	—	7	—
1918	—	—	1	—	—	1	1
Total..	7	3	20	1	1	32	1

From the table it can be seen that the Parallel Feeder Protection cleared successfully 32 short circuited lines without a single failure where one of the parallel lines only was in trouble.

The multi line short, which caused a total interruption, was caused by a crane unhooking a line wire and carrying it across the other line thus causing a double line short. Both lines were cleared correctly. The whole load, however, was thus thrown over to the third line, at that time only three lines being operated in parallel. Due to overload of the third line, the latter opened on overload and thus caused the total interruption.

Table II

Year	Effect on load from shorts cleared by the Parallel Feeder Protection.				
	Number of shorts causing following load drops.				
	No Load or less than 5% lost	5 to 10% load lost	15% to 30% load lost	30% to 50% load lost	50% to 100% load lost
1916	22	1	—	1	—
1917	5	1	—	—	1
1918	1	—	—	—	—
Total.....	28	2	—	1	1

Table II gives a clear indication how satisfactory the Parallel Feeder Protection proved in regard to saving the synchronous load.

The case, where nearly all load was dropped, was due to a 3 phase short outside the generating station caused by 12,000 V. wires blowing up into the line.

Based on the satisfactory results obtained on the 60,000 V. line protection it was decided to equip the whole 12,000 V. Toronto system with a similar system of Parallel Feeder Protection for all groups of 3 parallel feeders. This was done with the double object of trying, in case of a cable trouble, to save the particular substation from a total interruption as well as to obtain instantaneous clearance and thus save the rest of the system from serious secondary disturbances as would occur if depending on the time limit protection. This work was completed during 1917, so that since then the whole main transmission and distribution system has been equipped with selective instantaneous protection, leaving the Time Limit Overload Protection only as a kind of standby.

On two occasions 12,000 V. cable faults were cleared selectively by the Parellel Feeder Protection without loss of load. In some other cases the protection was unable to operate properly because the current transformers, feeding the Parallel Feeder Protection, were the cause of the short. In another case a switch stuck, although the relays had tried to open the switch correctly.

The less fortunate performance of the Parallel Feeder Protection on the 12,000 V. Toronto distribution is therefore entirely to be attributed to other causes than relay failure. The results on the 60,000 V. lines are sufficient proof of the correctness of the principle and its effectiveness.

Double Line Protection

During the period of 1914 to 1916 effective protection against lightning interruption was obtained from Nicholson's Arc Extinguisher. The Arc Extinguisher was able to save the interruptions in about 75% of all lightning shorts; the big drawback, however, was that in practically all cases almost all synchronous load was lost so that the benefit derived from the device was only partial.

It was felt that parallel operation on two lines equipped with an effective and instantaneous Double Line Protection, should save as many interruptions as the Arc Extinguisher and should be decidedly more effective in preserving the synchronous load.

From records of section operation of the two circuits on one tower line it was deduced that in only about 25% of all lightning shorts both lines were affected simultaneously, so that in 75% of lightning shorts a double line protection could be expected to clear the short circuited line without interruption to the system, which figure was found about even with the results obtained from the arc extinguisher.

From the operating results of the Parallel Feeder Protection it could be concluded that an instantaneous Double Line Protection should clear line shorts without effect on the load and would therefore, prove so much more effective than the Arc Extinguisher.

The use of the Parallel Feeder Protection during lightning storms was not practical because of the fact that only two out of four lines were considered lightning safe, the others having old insulators, extremely sensitive to puncture and power-arc.

It was necessary therefore to develop an effective Double Line Protection. It was realized that only a scheme based on current balance could offer the desired results, as only such a scheme could be expected to be quick enough to save the synchronous load and eliminate dangerous power-arc destruction of insulators.

Reverse power relays, even if connected as balanced protection, were not favoured by reason of sluggishness and uncertainty of action for shorts near the station, even with modern relays and connections.

Mertz-Price protection was excluded for practical and commercial reasons because of the length of the line.

A solution therefore was sought in a plain current balance between the same phases of the two parallel lines, taking advantage of the fact that, under our conditions with synchronous load and steam station at the receiving end, a short circuited line will manifest itself by drawing more current than the sound line.

Such a Double Line Protection was installed in 1917 and has been in operation ever since, a detailed description of the protection is given later.

As long as three and four lines were available the Double Line Protection was used only during lightning storms, or when ever other operating conditions arose leaving only two lines in service. Since the change to 90,000 V. operation with only two lines available, the scheme has been in service continuously.

The following gives the operating results of the Double Line Protection:—

Table III **Record of troubles during double line operation.**

Year	Single line shorts successfully cleared by Double Line Protection without causing interruption.				Double line shorts causing total interruption					
	Lightning	Insl. failures	Miscl. outside interference birds tel. wire etc.	Unknown cause	Tests	Sleet & wind	Total	Lightning	Wind	Total
1917	14	2	—	—	4	—	20	4	—	4
1918	6	1	2	—	—	—	9	2	—	2
1919	17	1	3	5	—	—	26	5	1	6
1920 (11 mos.)	21	—	3	7	—	11	42	2	—	2
Total....	58	4	8	12	4	11	97	13	1	14

From the table can be seen that the Double Line Protection cleared a total of 97 line shorts without a single failure as long as one of the two lines only was involved. It may also be mentioned that the short circuits were single phase and 3 phase shorts of every possible location between the two extreme ends of the lines.

In 14 cases the short circuit involved both lines so that the relay protection was useless. To clear any possible doubt as to whether some of the shorts tabled under double line shorts may in reality have been improper relay actions it may be mentioned that each such case was carefully analyzed and in practically all cases sufficient information of various kinds existed to prove the conditions of a double line short. It is also significant that with the exception of one case all double line shorts were due to lightning. Double line shorts under such conditions are naturally to be expected due to the proximity of the two circuits carried on the same steel tower line. The double line short marked under wind was due to the collapse of one of the double circuit steel towars in a cyclonic storm.

Regarding lightning operation on the Double Line Protection it may also be mentioned that in about 95% of the cases the line could be closed back immediately as it was not disabled permanently.

This satisfactory result is partly to be attributed to the instantaneous action of the relays and partly to the rugged build of the line insulators.

Effect on load from short cleared by Double Line Protection

Table IV

Year	Kind of operation	Number of shorts causing following load drops				
		No load lost or less than 5%	5 to 15% load lost	15 to 30% load lost	30 to 50% load lost	50 to 100% load lost
1917	60,000	13	5	—	—	2
1918	60,000	6	2	1	—	—
1919	90,000	9	12	5	—	—
1920	90,000	13	16	7	5	1
	Total........	41	35	13	5	3

From Table IV will be noticed that the load loss in all cases, except eight, was less than 30% and in most of cases below 15%.

The two cases of 1917, where practically all load was dropped, were 3 phase shorts very close to the generating station. The six cases of 1920, with more than 30% load loss, were all due to sleet and wind, involving probably all 3 phases in most cases.

In comparing the results on 60,000 V. operation in the years 1917 and 1918 with the results on 90,000 V.

operation during 1919 and 1920, it will be noticed that 90,000 V. operation seems to cause more load drop. This is apparently due to the fact that any line short on 90,000 V. operation will pull down the bus voltage materially more than in case of 60,000 V. operation, even in case of shorts in the middle of lines.

Ground Selector

With the completion of the instantaneous selective protection of all parallel operated lines by means of the Parallel Feeder and Double Line Protection there remained one other kind of serious trouble to be overcome, namely, grounds in the 12,000 V. Toronto distribution.

This distribution system consists of about 80 miles of underground and an equal mileage of overhead distribution all fed from the same bus bar. Due to the large extent of this system grounds develop quite frequently.

Permanent grounds very often have caused cross shorts at other points of the system. There was no means available to detect or select the faulty feeder. As a result it had to be detected by cut and try method, interrupting one feeder at a time.

Such procedure was so slow that usually a cross short developed before the faulty feeder could be located and in practically all cases it meant unnecessary interruption to smaller or larger parts of the system. In several instances the entire service was completely paralyzed.

It was felt therefore that some scheme had to be developed which would clear selectively and within the shortest possible time any grounded feeder.

The possibility of providing an artificial ground by means of a group of grounding transformers was first studied. It was found, however, that any such scheme would become very costly if arranged so as to offer the same amount of protection as the short circuit protection. The deciding factor was that the ground transformers should be so dimensioned as to supply sufficient current to assure the highest set sub-station feeders to open on time limit protection in case of a sub-station bus bar ground.

A closer investigation of this point disclosed the fact that under minimum short circuit current conditions, that is with the minimum number of generators at the power house, and with one transmission line only in service a short circuit at the steam station developed barely sufficient current to trip the 4 fenders on short circuit protection.

Therefore, for a ground under similar conditions and with the use of a scheme having grounding transformers there were only two ways open. Either the grounding transformers had to be made of negligible reactance to prevent any choking in the fault current as compared with short circuit conditions thus enabling the existing phase protection to take care of shorts and grounds; or the grounding transformers had to be made of higher reactance, but in this event special low set ground relays had to be installed to operate on the limited ground current in place of the high set phase relays. The first scheme would have meant very large capacity grounding transformers. The second scheme would have reduced the size of the grounding transformers but instead would have meant the installation of a special sensitive ground protection which would have required an extensive equipment of extra relays and current transformers since the available current transformers were fully loaded. Although cheaper, the second scheme would have involved considerable expenditure combined with many complications because of the limited space for extra current transformers.

The idea of grounding transformers was therefore dropped and instead we adopted the scheme which is hereafter named Ground Selector and described in detail later.

The fundamental idea of the Ground Selector is as follows: Any ground developing on the system will immediately be developed into a short circuit by automatically closing another phase to ground at the terminal station, thus artificially completing a short circuit path. Short circuit current will then pass out into the faulty feeder and will operate the phase relays selecting and cutting out the faulty feeder in the same manner as if the feeder was short circuited.

In order to obtain identical current conditions, under-ground and short circuit conditions it was first intended to provide dead artificial grounds. However, it was finally decided to introduce a very low ground resistance in form of a large water rheostat which would hardly affect the magnitude of the fault current under the most limited current conditions but would offer the great advantage of keeping up the bus-bar voltage in case of grounds close to the terminal station, thus helping to keep the synchronous load in step.

The Ground Selector was put in service in 1918 and has proven very effective and beneficial as following operating records will indicate:—

Grounds in 12,000 V. Distribution

Table V

(A) Feeder grounds effectively cleared by action of Ground Selector.	Sept. 1918 to Dec. 1919	Jan. to Nov. 1920	Total
Permanent Troubles			
Cable troubles....................	4	1	5
Bad insulators....................	4	3	7
Bad current trs....................	3	4	7
Operator mistake....................	1	—	1
Testing faulty feeders..............	5	15	20
Transient Troubles			
Lightning..........................	3	4	7
Unknown (customers grounds or outside interference)............	26	13	39
Total..........................	46	40	86
(B) Momentary, self clearing grounds, starting Ground Selector, but clearing before ground switch closed......			
Cause unknown....................	23	18	41
Grand total....................	69	58	127

In all the above cases the Ground Selector performed its duty correctly, causing a short circuit current of sufficient magnitude to enable the faulty feeder to open on overload protection.

Since the installation of the Ground Selector no secondary breakdowns of insulation have been experienced, nor has a ground caused any tie-up except to the faulty feeder itself.

From Table V. will also be noted that about one third of all grounds are self clearing grounds which clear without causing any short or any interruption. The Ground Selector shows, in this respect, a decided advantage over a grounded neutral system since in the latter case all grounds would be shorts.

2. Detailed Description of Protective Devices

Current Balance Protection for Three or More Parallel Lines

For any such system discriminating action can be obtained by relays being energized from current transformers only.

The underlying principle of the protection, described hereafter, is based upon the fundamental fact that the current of a line becomes unbalanced relative to the same phases of the parallel lines when that line becomes faulty, whereas the current will remain balanced with at least some of the parallel lines as long as the fault occurs in one of the other parallel lines. This will be more clearly realized from the following illustrations of short circuit conditions in a system of 3 parallel lines.

Fig 3ᵃ

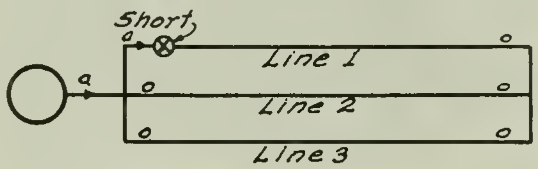


Fig 3ᵇ

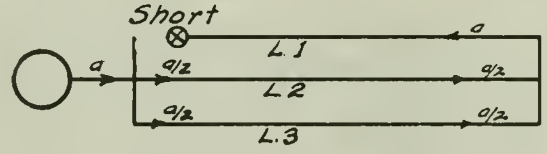


Fig 4

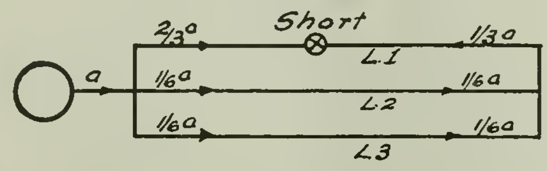


Fig 5ᵃ

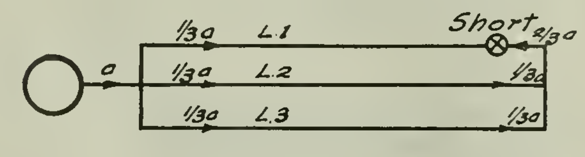
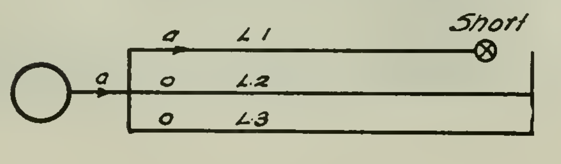


Fig 5ᵇ



All illustrations represent schematically one phase of a 3 line system with generator capacity at one end only. The letter (a) designates the total short circuit current supplied by the generating station and the fractional figures indicate the proportional portions of current passing through the various parts of the three line system. The arrows indicate the relative direction of current flow.

Figure 3 represents the condition of a short directly outside the generating station. All current will concentrate in the faulty line. Assuming the faulty feeder is successfully cleared at this point, then, immediately thereafter, condition Figure 3b will occur with the current from the generating station flowing equally distributed over the two sound lines into the sub-station and from there into the faulty line. Under this condition, at the sub-station end, the faulty feeder will show unbalance compared with either of the sound lines, while the sound lines remain balanced as to each other.

Figure 4 represents the conditions of a short in the middle of the line. Under this condition unbalance of the faulty line will shown up simultaneously at both ends.

In Figure 5a a short at the extreme end of the line is shown. Current at the sub-station is unbalanced in the faulty line compared with the sound lines, while at the generating end the three lines are still balanced. Assuming the faulty line at the sub-station end is cleared successfully then, immediately following, condition (5b) arises, with the faulty line now showing unbalance at the generating end.

It will, therefore, be realized that any kind of a line short on a system of 3 or more parallel lines will always produce an unbalance in the faulty line as compared with the sound lines, while any of the sound lines will, during the short, remain in balance with the other sound lines.

Therefore, an arrangement of differential relays coupling a feeder with the various parallel feeders, and with the trip circuits of the differential relays interconnected in such way that the joint action of the relays will trip the feeder unbalanced with respect to at least two or all parallel feeders, will thus be able to select and clear a feeder at fault without interfering with the service over the other feeders. Such automatic clearance will occur either simultaneously at both ends of the line (Figure 4) or successively (Figure 3 and Figure 5), depending on the location of the short.

Figure 6 shows schematically the protection for a three line system. Line 1, for instance, is protected by the joint action of the two differential relays (a12) and (a13), responding to any line current difference between the lines denoted in the index attached to the letters marking the various relays.

Whenever a short develops in line (2) or line (3), line (1) will become unbalanced relative to the faulty line causing the respective differential relay to trip. Line 1 will remain balanced, however, with the other sound line and as a result the second differential relay will stay open and thus prevent line (1) from tripping.

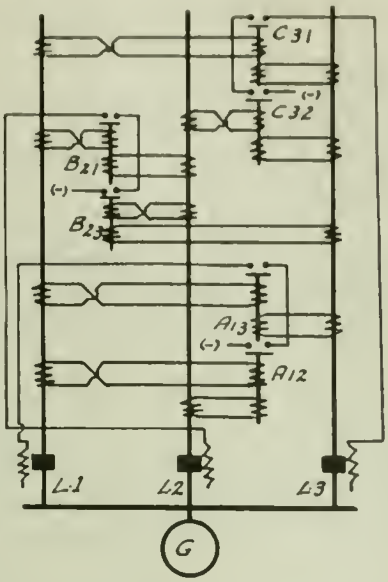


Fig 6

Should the fault be within line (1) the line will become unbalanced relative to line (2) and line (3) and as a result both balance relays (a12) and (a13) will come into action and will thus correctly clear the faulty line.

Similarly, differential relays (b23) and (b21) provide the protection for line (2) and relays (c32) and (c31) for line (3).

With an arrangement as shown in Figure 6 six differential relays would be required for the protection of a three line system. By close inspection of the diagram it will be noticed that in the whole combination two relays each form differential relays for the same two lines, the only difference being that the trip contacts of the two relays are inserted in two different trip circuits.

The scheme can be modified to an arrangement as shown in Figure 7. This reduces the total number of relays required to half the amount, by the use of differential relays having two independent trip contacts, each contact being inserted in one of the trip circuits of the two lines from which the relay is energized.

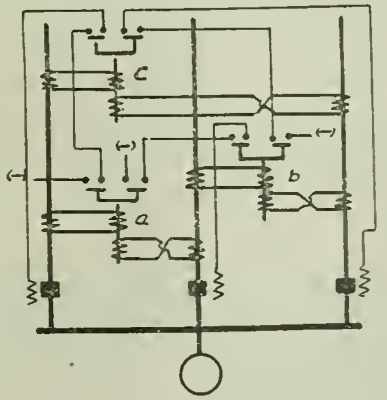


Fig 7

In this new arrangement relay (a) replaces relays (a12) and (b21) of scheme Figure 6, while (b) replaces (b23) and (c32) and finally relay (c) replaces (c13) and (c31).

It is quite natural that the relay coils, energized from the same line, will in actuality be fed from the same current transformer and not as schematically shown. The schematic arrangement, showing each relay coil being fed from a separate current transformer, was chosen only to show more clearly the relation of the various lines with regard to the respective relays.

The same principle as illustrated for the three line system can be applied for any system of 4 or more parallel lines. In any such case two ways are open to obtain the same result—either each feeder can be coupled with 2 parallel feeders to form a combination as shown in Figures 6 and 7 or each feeder may be coupled up with all parallel feeders. The latter scheme will require more relays but will be more convenient in operation as it will permit the disconnection of any line without disturbing the effectiveness of the protection so long as three lines remain in service.

With 2 lines only left in service the protection will have characteristics similar to the split conductor scheme, which is that for shorts beyond the lines the protection will remain inactive and for shorts within one of the lines the protection will clear both lines without discriminating.

With one line only left in service the protection will act as an instantaneous relay.

The differential relays have been shown in the foregoing diagrams to all be of the magnetic differentiation type, that is, relays with two independent current coils, each coil being fed from one of the two lines, the coils bucking each other normally with normal current flow in the two lines as shown schematically in Figure 8a.

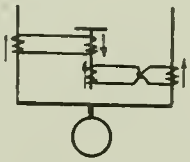


Fig.8ª

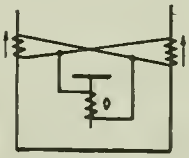


Fig.8ᵇ

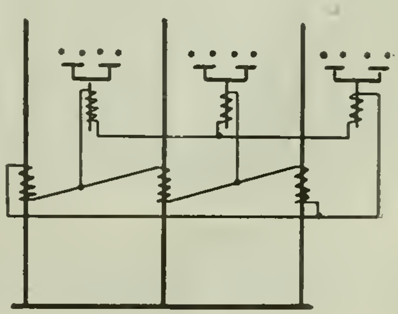


Fig.9

In a similar way electrical differentiation can be applied by connecting the current transformers in series to each other with the relay coil shunted as shown schematically in Figure 8b.

Figure 9 shows the 3 line protection similar to Figure 7 but with relays connected by electric differentiation.

The described protection while being somewhat complicated as to wiring, offers, however, the great advantage that it is free from the complications and uncertainty of action germane to the protective schemes using potential elements; moreover it does not require pilot switches on the oil switch mechanism.

Its action is absolutely positive, dependable and instantaneous.

Current Balance Protection for Two Parallel Lines with Generator or Synchronous Capacity at Either End

With generator capacity at both ends of a double line circuit, such as the tie lines between powerhouses, or with generator capacity at one end and synchronous motors at the other end, a discriminating protection can be applied which will require for energization current elements only.

The protection, hereafter described, obtains discriminating action by making use of the fundamental fact that under the conditions above mentioned the current values in the faulty phases of the faulty line will exceed the current values of the corresponding phases of the sound line.

This is illustrated in Figure 10 to Figure 12 for short circuits at various points of the lines. All figures show schematically one phase of a double line system with synchronous capacity at either end. The letters (a) and (b) designate the total short circuit current supplied by the respective ends. The arrows indicate the relative direction of the current flow in the various parts of the system.

Figure 10a deals with a short within closest proximity of station (A). The current from station (B) will in this case divide equally between the two lines. Balanced condition, therefore, will prevail at station (B) between the two lines. At station (A), the current portion (b/2), coming in over line 2, will add to the current from station (A) the sum (a+b/2) flowing into the faulty line. At station (A) the faulty line will show an excess current over the sound line. Assume that a balance type relay, to be described later, will open the faulty line at station (A), due to excess current as compared with the sound line, then, immediately after the switch has opened, condition (10b) will obtain.

From Figure 10b it will be noted that at station (B) the faulty line will show an excess current as compared with the sound line, so that the same method of tripping would also become effective on that station end.

Fig 10a

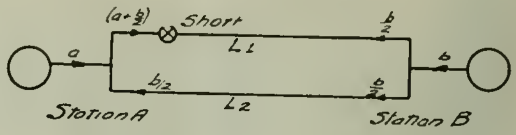


Fig 10b

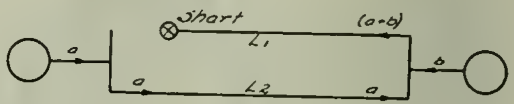


Fig 11

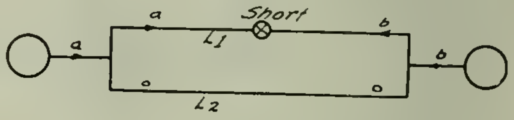


Fig 12a

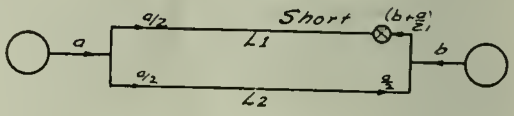


Fig 12b

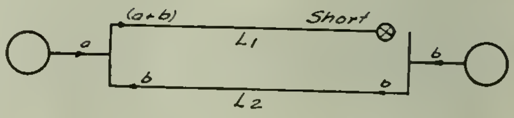


Figure 11 assumes the short circuit somewhere toward the middle of the line. At a certain point of the line there will exist a condition which will cause each station to discharge directly into the faulty line with the sound line showing zero current. Under this condition the faulty line shows an excess current at both ends simultaneously as compared with the sound line.

Figure 12a assumes a short directly outside station (B). Conditions in this case are similar but reversed as compared with conditions (Figure 10a). Excess current will show up on the faulty line at station (B) only, but immediately after the switch is opened a similar unbalance will show up at station (A) as shown in Figure 12b.

It will be noticed from the diagrams, that under the given conditions of synchronous capacity at both ends of the line, the faulty line will always show excess current in comparison with the sound line, be it simultaneously at both ends of the line (Figure 11) or successively (Figures 10 and 12).

A relay actuated by the excess current to trip the faulty line and simultaneously prevent the sound line from tripping can select and clear the faulty line without affecting the service over the sound line.

Various solutions serving such purpose can be chosen, two of which may be schematically shown.

In Figure 13a a lever pivoted in the centre may, when lifted to one or the other side, trip the oil switch of the respective side. Solenoids with plungers energized from the respective line current transformers are arranged under the extreme ends of the lever, so that a lifting of the plunger will push the lever into trip position.

With current transformers and solenoids having the two sides alike, the lever will be moved to the side of heavier line current, thus tripping the faulty line and at the same time blocking the trip of the opposite line.

Preference was given by the writer to an arrangement as indicated in Figure 13b. In this arrangement each side is an instantaneous relay with an independently movable contact lever; the two contact levers, however, are mounted on the same pivot pin and are provided with a boss having action such that the two lever arms can only move freely until they reach a position where one contact arm is the linear extension of the other one; so that one side only is able to make contact at a time, thus performing the same duty as the arrangement of Figure 13a.

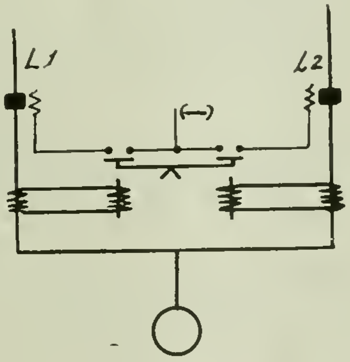


Fig 13^a

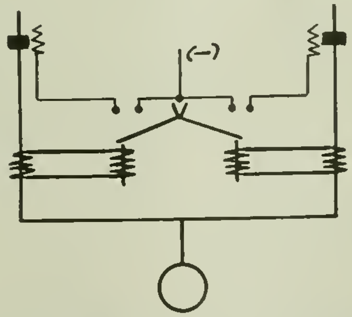


Fig. 13^b

Short circuits beyond the lines on the sub-station end would bring both sides of the lever arrangement into action with about equal force. No lever arrangement of the type indicated in Figure 13 would be able under such conditions to hold the lever in horizontal balanced position. Invariably one side would move up and make contact and thus unnecessarily trip a line. A balance relay, as shown in Figure 13 would be dangerous unless some provision were made to prevent such wrong tripping in case of shorts beyond the lines.

Here again different solutions offer themselves. The writer decided on the use of an additional relay, energized by differential current between the two lines and with the tripping contacts in series with the contacts of the balance relays of Figure 13 so that the joint action of the Differential and Balance relay only can trip a switch.

Figures 8a and 8b show two alternatives for energizing this differential relay from the current transformers of the two parallel lines.

Figure 8b shows electric differentiation by putting the two secondaries of the current transformers of the two lines in series with each other having the relay coil connected in shunt.

Figure 8a shows magnetic differentiation by energizing one coil of a two coil solenoid from one line and the other coil from the opposite line, the two coils so energized to buck each other with normal current flow in both lines.

Any short circuit beyond the lines will cause more or less balanced current flow in the two lines, so that under all such conditions the differential relay will not be actuated. Therefore the Double Line Protection will remain blocked even should the balance relay be moved into one of the two contact positions.

In case of actual shorts within one of the two lines, however, there will always be sufficient differential current between lines to actuate the differential relay and select and open, jointly with the balanced relay, the faulty line.

A third feature is essential to make the scheme effective and foolproof for all conditions.

Assume that a protection is installed equipped with balance and differential relay only, being a combination of relays, Figures 13 and 8, with the trip contacts in series. Then in a condition as shown in Figure 10 the following would happen:

The first initial short circuit current would open the faulty lines at station (A) establishing condition (10b). Immediately thereafter the sound line at station (A) would show excess current compared with zero current in the opened line, and as a result the sound line would trip also, immediately after the faulty line, thus causing a total interruption. It is essential, therefore, that the trip circuit of the sound line be blocked before the faulty line has cleared.

The natural solution of such automatic blocking would appear to be an auxiliary contactor arrangement on the oil switch, which, with the oil switch opening, would block the trip circuit of the opposite line. The writer felt that any such arrangement would be too uncertain, as such contactors might get out of order, and cause improper action. For this reason an electrically controlled blocking relay was adopted, energized by the oil switch control in such manner that the relay blocks the trip circuit of its line whenever the opposite line switch opens and vice versa.

From the foregoing it will be realized that all three features described are essential to make the scheme effective.

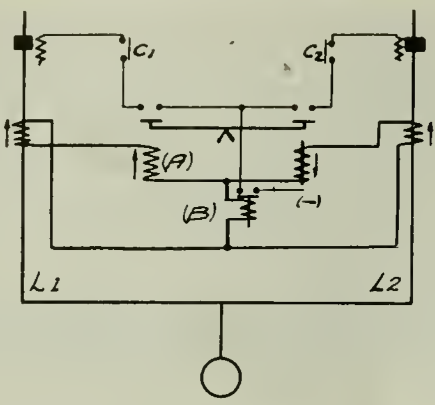


Fig. 14

Figure 14 shows a complete schematic diagram embodying all three features.

(A) indicates the balance relay, selecting the faulty line.

(B) represents the differential relay which prevents wrong action of the balance relay in case of shorts beyond the sub-station.

(C1) and (C2) represent the automatic blocking switches operated by the electrical control of the opposite line switches to prevent the sound line immediately opening after the faulty line in case of shorts at the extreme ends of the lines.

A scheme equipped with these three features will prove effective and discriminating for any kind of a line short, provided one of the two lines only is in trouble.

Ground Selector for Ungrounded Three Phase Distribution Systems

A ground, occurring on a non-grounded distributing system, will be felt over the whole system. There is normally no means available to locate the faulty line except by disconnecting alternately individual sections of the system and observing whether the ground disappears. Such cut and try method is rather slow and always necessitates the momentary interruption of a larger part of the system than necessary, since many of the sound feeders may first be disconnected until the faulty feeder is located. The ground will cause a 73% increase of voltage on the two sound phases to ground, and if left on for any length of time may cause the breakdown of another weak spot at an entirely different part of the system.

To reduce to a minimum the damaging effect of a ground, it is essential to provide means to have the grounded section cut out selectively and within the shortest possible time.

The ground selector has been developed to accomplish such selective and immediate clearance of a grounded feeder.

The fundamental idea of the ground selector is to produce intentionally a short circuit immediately after a ground develops on the system. This is accomplished by automatically grounding one of the sound phases at the main station bus by means of closing an oil switch, immediately upon the occurrence of a ground. Thus a complete phase to phase short circuit is produced and as a result overload current will flow into the faulty line, as if the line was on short circuit. Accordingly the ordinary overload protection will enter into action and disconnect the faulty line. As soon as the faulty feeder has cleared itself, the ground switch will open automatically and thus restore the system to normal condition.

Figure 15 shows schematically the principle features of the device. P1—P2—P3 are single phase potential transformers with their primary connected in star and with the star point grounded. The secondary of these transformers is connected to overvoltage relays R1, R2 and R3, which latter, two in joint action, close the ground switches. The so-called transfer relays T1 and T2 are provided to assure an automatic clearance of the ground switch after the faulty line has cleared, as will be explained later.

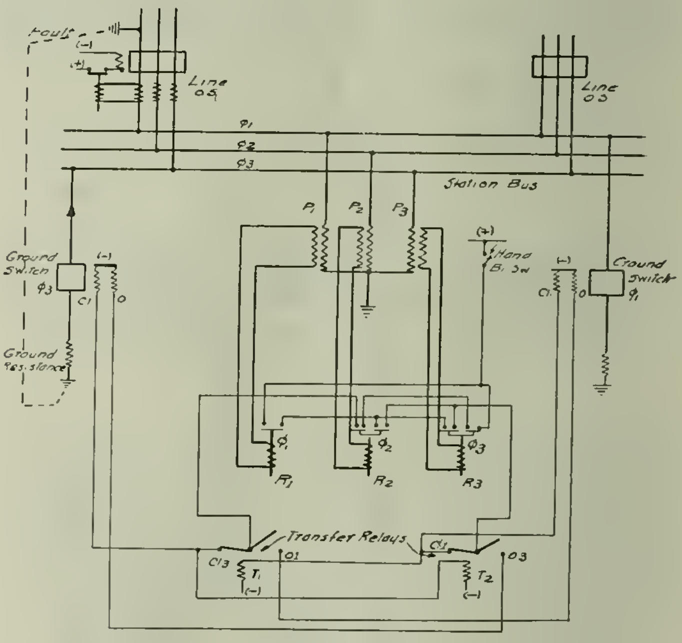


Fig 15

Normally the three phases of the system will be balanced to ground, and as a result the potential on the transformers P1—P2—&P3 will be the same and equal 58% of the voltage between wires. A ground on one phase will tend to lower the voltage on the transformer, which corresponds with the grounded phase, and at same time the voltage on the other two phases will tend to rise toward a value equal to line voltage, that is 1.73 times normal voltage to ground. This overvoltage on the two sound phases is made use of to trip the two corresponding overvoltage relays and thus cause, by their joint closure, the automatic closing of one of the ground switches.

For instance a ground on phase (1) will cause a high voltage on phases (2) and (3). The joint trip of relays R2 and R3 will close the ground switch phase (3) thus causing a complete short between phases (1) and (3) and causing the faulty line to clear on overload. After the faulty feeder is cleared from the system a ground would remain due to the ground switch still being in closed position. In our particular example the ground would remain on phase (3) due to ground switch (3) remaining closed. The overvoltage relays of phase (1) and (2) would therefore trip and close ground switch (1) thus causing a bus bar short if no special provision were made as by the installation of a transfer relay, to prevent such action.

The transfer relay blocks the closing circuit of the second ground switch immediately upon the closing of the first ground switch, and at same time prepares for the tripping of the ground switch which has been closed. When ground switch (3) closes, it energizes the coil of the transfer relay (T2) throwing the lever over into the other contact position. In this position of the lever high voltage on phase (1) and (2) due to ground switch (3) being in closed position, will trip the ground switch (3) and thus re-establish normal conditions instead of closing wrongly the ground switch (1). Transfer relay T1 will in a similar manner prevent the closing of ground switch (3) and assure the opening of ground switch (1) when overvoltage relays R2 and R3 will trip after a ground on phases (2) or (3) has been cleared, leaving ground switch (1) closed.

The above is a description of the essential features of the Ground Selector.

Various other features had to be embodied to make the device practical. These additional features are not shown in the schematic diagram but may be briefly discussed in the following:—

The sketch shows 3 overvoltage relays only and no provision to prevent these relays tripping on 3 phase overvoltage, as may occur from various reasons. Such action would not be harmful in itself, since none of the ground switches would be able to close. The closing circuits would be ruptured instantly by the transfer relays upon the initial energizing of the circuits. However, their action would unnecessarily alarm the operator and necessitate the re-setting of the device. For this reason a balance potential relay has been introduced which only responds to an unbalance of potential to ground.

This relay keeps the actuation of the phase overvoltage relays blocked so long as it is not actuated itself. It therefore prevents the device from getting into action during three phase overvoltage.

As a precautionary measure for any unexpected action on the part of the ground selector, the ground switches are equipped with overload relays, set sufficiently high for the line protection to clear before the ground switch opens.

As a further precaution, each ground switch is provided with complete electric control which enables the operator to actuate the ground switches by hand, if necessity arises.

A hand blocking switch is also provided by means of which the automatic features of the device can be stopped without, however, interfering with the hand control of the ground switches.

A ground resistance is provided in series with the ground switches. This resistance is purposely made low so as to influence only slightly the magnitude of distant short circuits, but having a tendency to hold up the bus voltage for grounds very close to the station.

The Ground Selector will operate once only and will have to be reset by hand by moving the transfer relay into the original position before it is ready for new action. This, however, does not cause any inconvenience, and has been found preferable to an automatic resetting which latter might cause trouble should a ground develop into a short and clear the feeder before the ground switch has been closed completely.

General Remarks

With the completion of these various protective schemes it is hoped that serious tie-ups due to defectiveness of the relay protection will be a thing of the past.

This, of course, does not mean that interruptions may be entirely eliminated since there are troubles which may arise where no relay protection can be of any help, such as double line shorts on the 90,000 V. transmission line from lightning, or bus-bar shorts, switch-failures, etc.

There is also room for many minor improvements but as a whole the operating records of the past few years clearly indicate the great improvements obtained in service.

It is especially gratifying to see the change in operating methods which have taken place since 1912. In those early days the only salvation was section operation in independent sub-systems so that trouble on one sub-system would not affect the others. Today if voltage conditions permit the Toronto transmission system is operated in parallel with the local Niagara Falls distribution with as much as 70,000 K.V.A. combined generator capacity.

The Toronto system, which in former years often was operated as two separate sub-systems during stormy weather, is now always operated in parallel as one distributing system.

The great advantages of such parallel operation are not to be underestimated as it permits more economic use of the generator and transformer equipment, also simplifying particularly operation and reducing the hazard from operator's mistakes.

In closing, the writer wishes to express his appreciation for the encouraging support received from F. G. Clark, M.E.I.C., chief engineer of the Toronto Power Co., and the interest he has taken in the development of the various schemes which encouragement alone permitted the successful completion of the work.

The Pulp and Paper Industry of Canada

Forest depletion, suggested changes in lumbering regulations, with a discussion on the advantages of the long lease.

By Ferd. van Bruyssel, C.E., D.P.Sc.

Abstract of a Paper Presented at the General Professional Meeting, Montreal, January 29th, 1920.

The present day problems of the pulp and paper inducstry are of immediate concern to professional engineers, be ause they are fitted better than any other class of men to become executive officers in the production of pulp and paper. Primarily, they have sufficient theoretical and practical knowledge of the arts and sciences applied in this industry, to be able to exercise proper control over the specialists employed, such as chemists and mill superintendents. Furthermore, through experience in general or railway construction, engineers ordinarily have acquired business acumen, and have cultivated the faculty of understanding and leading men, such qualifications being essential in administrators of large manufacturing enterprises. Forestry operations, including reconnoitring, surveying, topographical plotting, locating and making roads, river improvements, mechanical means for cutting and transporting logs, all within our immediate scope as professional engineers, are now preferably conducted by progressive young men, who logically must be styled forestry engineers. Given a course in sylviculture, any civil or mining engineer also would be a forestry engineer. But whoever is only able to tend machines and to make good paper or to follow the process with the necessary chemical and physical tests, could not be expected to grasp the other features of the undertaking as a whole.

Forest Depletion

The greatest of the problems to which reference has been made has to do with the depletion of our forests: those same causes of denudation in the Eastern and North-Middle States of the Union are bringing about identical results within our own country and Province. Just as American paper mills have come to depend largely upon our wood or pulp, so certain Canadian mills — whose directors cast shrewd eyes upon the future — have commenced to reach out equally far beyond their own territory for that which is their staple material.

Regarding the threatened loss of our readily accessible forest wealth, it is probably true that the first warning or alarm signal which found a distinct echo in the nation, was sounded by the late Sir Henry Joly de Lotbinière, one of the most deeply regretted men among those it has been the writer's privilege to know, and to the intervention of another charming and distinguished personality, Mgr. Laflamme. Either to their indirect influence or to their personal initiative, we owe the awakening of a popular interest in the preservation of our forests, the constitution of the Dominion Forestry Association, of the Federal and Provincial Forestry services, the establishment of Forestry Faculties in the Universities of Toronto and Laval. We are indebted highly to the dean emeritus of the former, Dr. B. E. Fernow, for his untiring pioneer work in this connection. Owing to the inspiration and teachings of both himself and his young Quebec colleague, G. C. Piché, A.M.E.I.C., who also heads the Forestry service of the local Government, there are now available an increasing number of special graduates for dealing expertly with the forest. Pulp and Paper Companies, first the Laurentide and next the Riordon, have become quite seriously engaged in such operations.

Because of the remoteness of the crop in point of time, reforestation on Crown lands is essentially a State affair, in which intervention by the pulp and paper companies can only be accounted for by their hope to subsist during several spans of tree life. Although assistance from private sources is to be welcomed, the burden and imperative duty of preserving the trees undoubtedly lie with the public authorities. They have to consider, for the welfare of present and future generations, not only the value of wood, as such, but the climatic and cultural influences of the forest, its bearing upon the water flow, also upon the prevention of erosion and sand frifting.

The Quebec Government has evidenced full appreciation of the immense responsibilities involved. It is only fair to pay a passing tribute to the present Provincial administration, which is recognized to be patriotic, progressive and wise — a combination of qualities one should not have expected to find in a ministry elected under a system of universal suffrage, unattended as yet by any measure of proportionate representation.

Let us note with pleasure that, in this Province and others, constant attention is being given to the differentiation between lands arable and lands unfit to bear anything but trees, or so situated on mountain slopes, on the banks and in the drainage basins of rivers, that deforestation there must entail disastrous results. Such classification should be made absolutely secure and insuperable; permanent barriers should oppose the advent of fraudulent settlers intent upon wood piracy, and of deluded settlers, pitching upon ingrate and shallow soil.

Suggested Changes in Lumbering Regulations

The point is now reached where it becomes necessary to enter gradually upon more controversial ground, beginning with a denunciation of the prevalent methods of lumbering. It is believed certain changes in the existing regulations applicable to felling on the Crown domain are under advisement. These changes would make it quite feasible to exploit economically while increasing the productivity of the forest. Just now, it is invaded by jobbers and their hordes, who are free to prey upon all conifers of more than a prescribed minimum diameter. Poplars and other deciduous trees in remote places are not attacked. As a consequence, the spare stands are no longer mutually supporting units in a solid mass, for this has become pitted with the voids first made by saw and axe, and subsequently enlarged by wind falls. In these voids naturally are seeded quick growing, leaf bearing trees whose crowns soon dominate the remaining conifers, so impeding and even arresting their further vegetation.

The encroachment of hard wood over coniferous trees in the vicinity of settlements and in forests exploited under present methods is noteworthy, where the continuous selection of pine, spruce, balsam, cedar and hemlock must in itself tend to cause other trees finally to prevail. The writer favours, wherever practicable, the plan of clear cutting within narrow strips. This would generally necessitate an 80 year rotation with thinnings (making so much pulp wood) after the thirtieth year, and every ten years thereafter. And it will be found on careful computation that if spared from fires and other natural agents of destruction, an area of two or three thousand square miles, according to region, will be more than adequate continuously to supply a 250 ton paper mill.

The enhanced cost of clear comparatively to that of selective cutting will be compensated by the greater initial yield — apart from the future one — and the only additional expense entailed under the suggested method is that of providing at the proper time a skirmish line of axe men, to exterminate deciduous leaved saplings, and possibly to effect some judicious thinnings in the coniferous growth. Among other advantages, pray consider the easy task of piling the brush preparatory to burning it, on a narrow razed strip; whereas snaking the brush between trees to a suitable spot for incineration is an onerous job which nobody in this Province has cared to under take or to impose, despite the relation between a littered forest floor and the propagation of both fires and injurious insects.

However, no system can be generalized, and modes of exploitation must depend upon the varying conditions of soil, climate and topography. Therefore, speaking of Quebec, it is the writer's belief that official regulations will come to be so framed that no licensee can operate until his cutting plans have been sanctioned by the Forestry service of the competent Department.

Experiments based upon known methods of exploiting the natural forest are very properly being conducted in various locations by our newly acquired scientific foresters; but the writer is at issue with any who would have us defer for a half century, or until such time as the final results of the experiments may have been recorded, the accomplishment of reforms which are imperatively needed at once, if any natural forest is to be left for improvement.

We already know full well that the present practice of taking out the best trees here and there is ruinous; that an improvement upon this consists in removing the useful timber, while having some regard for the future of the young growth, the eradication of weed trees and the sparing of necessary seed trees. In another method, trees are felled in groups, so as to provide openings for natural seeding, such openings being periodically enlarged, after the young growth is well established, to obtain a further young growth in more or less concentric rings. Finally, the clean cutting method, already described, receives various applications designed to secure protection from wind for the trees remaining uncovered on the side next to the razed strips.

While the relative merits of all these sylvicultural systems have been proven in European practice, there is a tendency in Canada to make light of such experience, under the mistaken idea that conditions on the one continent are entirely different from those prevailing on the other. However, in either case are to be found conditions, both economic and natural, so similar as to call for identical processes. In parts of Scandinavia, the climate, soil, vegetation and fauna closely resemble our own; moose and beaver bestir themselves among spruce and alder and birch and mountain ash. There can be no reason for ignoring data recorded in such an environment, by experts trained in the same schools as our first instructors in the economics of forestry.

Tenure of Timber Limits in Quebec

There is now something to be said on the Quebec tenure of timber limits, since the very existence of paper mill companies depends thereon, particularly if the investment of several million dollars they have made in plant has been located near the source of wood supply, at some remote inland spot connected with the railway.

If a capitalist, or representative of some financial group intent upon industrial promotion, should recognize on first inspection the apparent advantages of a certain Quebec location for the establishment of a paper mill, nothing can be done in development until time and treasure be spent for quantitative, qualitative and cost investigation of the proximate forest, available water power, site for the plant, labour and transportation Should the findings lead to further action, the next and only step is to put in a petition for the sale by auction of the limits involved, (Art. 1623 of the R.S. Quebec). But it may be the right policy for Government to defer such sales for years, or at any rate until prospective transactions warrant the advertising and other expenses involved. Meanwhile, the favourable moment for embarking upon the project may have passed; or the parties may have become interested elsewhere. Assuming, however, that the sale be called in good time for the promoters, they must meet there the competition, not only of speculators, but also of operators who would carry off the timber for use in other parts, thereby destroying a natural combination of power and raw material which should have been utilized for the establishment of a great industry. Granted that such competition be overcome in the bidding, or that title be acquired by subsequent purchase, the result is an enhanced outlay, representing interest which ever is to remain a fixed charge upon the wood cut in each year; and while selling at the highest obtainable price is of fiscal benefit to the Province, it may be more in the general interest to avoid impairing the advantage which our possession of relatively cheap wood affords in the international struggle for supremacy over the paper trade.

We have been referring to the title obtainable at public auction to timber over part of the Crown domain. What is the nature of this title? In the terms of the law (R.S. Quebec, Art. 1597) it is a license "to cut timber on ungranted lands of "the Crown at such rates, and subject to such restrictions as may, from time to time, be established by the Lieutenant Governor in Council, and of which notice shall be given in the *Quebec Official Gazette*".

Art. 1598 provides that "No license shall be granted for longer than twelve months from the date thereof....."

Art. 1600 stipulates that "such license shall vest in the holder thereof all rights of property in all trees, timber, and lumber cut within the limit of the license during the term thereof, whether cut by authority of the owner of the license, or by any other person with or without his consent".

The regulations now in force by virtue of the first cited article of the law are embodied in an Order-in-Council under date of 26th. April 1910, revoking all previous regulations "incompatible with the present" and amended in its turn by an Order-in-Council of 13th. June 1918.

The clause having a distinct bearing upon the answer to our question is as follows:—

"Licenses expire on the thirtieth of April following the date of their issue, but the licensee having complied with existing regulations is entitled, up to the first of September following, to a renewal of his license. He shall forfeit such right through any infringement of the law and of the regulations. The Minister of Lands and Forests may, however, permit the renewal of the license on payment of the ground rent and of any other penalty he may be pleased to impose".

Regarding the right to renewal, the recited text of the Order-in-Council has not always been constructed in the light of the law whence it originates. But we may perhaps safely conclude that any and all contradictory interpretations would surely be supported most ably by distinguished barristers. On the one hand, from the inception of the system, renewal for licensees in good standing has been so absolutely and invariably conceded as to create a rule or precedent upon which might properly be founded a claim to the existence of a vested right, or of a tacit agreement. Conversely, it may be contended that perpetual alienation can never have been intended by the legislator, and such opinion might be sustained by recalling an Order-in-Council of Oct. 2nd. 1868, which, although repealed, is quite illuminative of what has been done and can be done again to limit the period during which yearly licenses are renewable. For it is decreed, in words translated from the French, that "licenses for rental of timber limits be renewable annually for a period of time to extend until the 30th of April 1889, Government reserving the right to change the stumpage tax once during such period, but this shall not be done before the 1st. of September 1878".

Advantages of Long Term Lease

Certainly, we remain confident that, in their wisdom, such a Government as it is our privilege to have now in office would strenuously oppose any measure calculated to jeopardize the great investments in the lumber and paper industries of this Province. Still these are troublous times of socialistic propaganda where one may well consider the expediency of resting the said investments upon the unquestionable foundation of a long term lease, instead of a yearly license, even if the latter be indefinitely renewable. In fact, such leases are now current in the case of water powers. The time limit might be fixed with due regard to the amortization of the capital outlay in plant or construction, and to the fact that the lessee must be allowed to reap sufficient benefit from the improved sylvicultural methods which should be made to prevail.

Let the rental equal the interest, at the rate of Government loans, upon a proper valuation of the limits. To conform with the law and to prevent collusion, the basis for rent should be determined by selling the lease publicly, the bids starting from an upset or reserve valuation. The lease would be subject to such conditions as (1) the erection and operation of a mill of a capacity proportionate to the resources of the given location as to timber and power; (2) the payment, besides rent, of the stumpage dues, actual or future, imposed upon all licensees.

So would be eliminated the speculator and the operator aiming to take the timber away from a location which it might be desirable to assign for a paper mill. And on request of any well qualified party, the limits and water power connected with such location could be reserved for a reasonable time to be occupied in actual investigation and survey, it being understood that, on further request, the lease of the limits would be sold by auction after sufficient public notice, and that the lessee of the limits would also receive a lease of the water power under the now established terms.

This arrangement must certainly serve to favour the building of new paper mills in all the remaining places suitable for operation on the large scale seemingly indispensable for success in the industry.

It is to be understood clearly that while it is proposed that the long lease system be applied in regard to all future concessions, it is not suggested that this system be imposed upon present licensees, who would not be disturbed in any way if it were adopted. But they must have the option to come under the new regime, or to remain under the old. In the former case, since any renewals of existing licenses are not subject to further public competition, the basis of rental might be, in all fairness, the premium originally paid for the limits, irrespective of transfer.

Apart from its trend for the general good, the proposal as outlined may commend itself to the Government, because it involves a regular if not an increased income for ordinary revenue, and consequently, a sounder financial status than is afforded by sporadic and uncertain returns in lump sums, properly for entry to capital account. Paternity of the underlying idea is disclaimed, since in Ontario, if not elsewhere, timber leases covering definite periods have been issued to pulp and paper companies.

Present-day Cost of Paper

Everybody knows that the pulp and paper industry has been progressing most remarkably in Canada within the last twenty years, and no statistics need be quoted here in this connection, but if particulars regarding the cost of making paper are desired, pray consider the following data. In 1917, the Attorney General of the United States instituted a proceeding in equity under the Sherman law against a number of American and Canadian manufacturers. They filed answers and consented to a decree. Prior to that decree, they entered with the Attorney General into an agreement with the object of proving that no unfair price had been charged for their product. This led to a thorough investigation of their books and records by Messrs. Price, Waterhouse & Co. and Perley, Morse & Co. These accountants included in the cost reports an item for stumpage of $2.00 per cord of rough wood for every company except one American company, and $2.40 per cord for that company; a charge of $3.20 for every ton of newsprint produced was also included for depreciation. Under these conditions, the total cost per ton of paper, in the case of nine typical companies concerned, ranged from $39.96 to $53.48 per ton in 1917 and averaged for the first quarter of 1918 from $46.87 to $62.39. And there is evidence to the effect that such cost, including no return on the investment, is steadily advancing. The wood is taken into the cost figure for the first quarter of 1918 at figures varying for the different mills from $9.56 to $16.83 per cord of prepared wood. Since one and one-tenth cords of prepared wood are required for the production of one ton of newsprint paper, the value of the wood in one ton of paper represents from $10.52 to $18.51. As to the value of the investment, it has been demonstrated to average from $40,000 to $45,000 per ton capacity exclusive of wood lands. On the basis of $45,000, and allowing 20% on this, we have a profit of $30 to be added to the costs. Allowing 10%, a profit of $15.00 is to be added to the costs. On the basis of $40,000, a 10% return gives $13.33 per ton to be added to the costs.

The following is an excerpt from the brief on behalf of the manufacturers, one of which is fully designated:—

"We shall now take up the schedule of costs, as made up and submitted by the accountants for the Federal Trade Commission, and we shall select therefrom the lowest average cost of any of the companies, for the first three months of 1918, — We find this to be the costs of the Belgo-Canadian Pulp & Paper Company, Ltd., to wit, $46.66. Adding $13.33 to this, it will be seen that the selling price comes to exactly $60.00. But by adding this insignificant rate of returns on this inadequate value of the investment, to the cost of other companies such as .... we arrive at a sum in excess of the price fixed by the Federal Trade Commission, as an alleged just and reasonable price."

In calling attention to the above record made by the Belgo-Canadian Pulp & Paper Company, the writer is not actuated by pride of nationality, nor personal gratification as initiator and founder of the organization.

Attention is called to the fact that the manufacture of paper requires, besides the original investment, a proportionately large working capital, of which the turn-over must be obviously slow. It is one of the largest of our industries, represented by about fifty separate companies on this Continent. Their annual aggregate production amounts to two million tons of newsprint paper, more or less. Only through ignorance, or in bad faith, have they been charged with profiteering.

On the brief for the manufacturers before the United States Circuit Judges, it is stated that: "The International Paper Company and the Spanish River Pulp & Paper Mills, Ltd. with an aggregate daily tonnage capacity of 1674 tons of newsprint paper, which is more than 25 per cent of the entire production in North America, have, for years been turning out this product with practically no profit to themselves. Think of the Spanish River Company producing 132,000 tons of paper annually for five years, or about 660,000 tons of paper, and failing even to pay the interest on its little bond issue of $12,000,000; think of the International Paper Company producing 17,200,000 tons of newsprint in twenty years, and only paying interest on a bond issue of $12,000,000 and a dividend on about $20,000,000 of preferred stock."

The tide having now turned in favour of the manufacturers, nobody should begrudge them the compensation which a long period of prosperity can afford. Nevertheless, they have been submitted to an unprovoked assault, which, in our own country, has been supported by the extraordinary power given to the Federal Government under war conditions.

Price fixing is justifiable only when directed against a real or virtual monopoly, responsible for an intolerable abuse, distinctly prejudicial to society. Manufacturers are not monopolists for taking full advantage in an open market, of prices rising because of an insufficiency of supply. Were the market a falling one owing to oversupply, no limitation of loss by the manufacturers would be expected from Ottawa. Society in general is not concerned any more than it is in the price of any commodity other than paper, since publishers have always been enabled to secure all their paper requirements on paying the prevalent price and taking the usual business precautions of making timely contracts. They have apparently become resigned to doing this in the United States, where the fixed price has been ignored by mutual consent under the stimulus of the inexorable economic law.

In Canada any true appeal to the patriotism of our publishers ever meets with the most generous response. Let us then exhort our publishers to consider the deplorable effect upon investors of a duel between an industry and its principal customers, bearing in mind that the latter wield the formidable power of the press, which never will be collectively used for purposes of self interest, as opposed to national interest.

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Amendments to By-Laws

The committee appointed to supervise the opening and counting of the ballot for the amendments to the By-laws and to forward the result to Council, reports as follows:—

The amendments to Section Three, Nine, Ten, Twelve and Thirty-two as submitted to the members have been approved. The proposed amendment to Section Thirty-four was not approved.

The vote is as follows:—

Section:	3	9	10	12	13	32	34
Aye:......	997	1002	998	1010	1013	992	504
Nay:......	49	41	42	29	28	34	551

Count of ballots by boxes before being opened:—

Box No. 1	285
Box No. 2	242
Box No. 3	522
Rec. later	21
	1070

Doubtful Ballots: 11

The amended By-laws therefore read:—

Section 3.

Classes of Members

The Institute shall consist of Honorary Members, Members, Associate Members, Juniors, Students and Associates. Honorary Members shall not be entitled to vote or to hold office, unless they have previously been Members. Members, Associate Members and Honorary Members who have previously been Members, shall be styled "Corporate Members", Junior, Students and Associates shall be styled "Non-Corporate Members". A Non-Corporate Member shall not be entitled to vote on *Institute* affairs, or to hold office as an officer of *The Institute,* or as Chairman or Vice-Chairman of a Branch. He may be entitled to vote on Branch affairs or hold office in a Branch, other than as specified above, when so permitted by the By-Laws of the Branch.

Section 9. (1st paragraph)

Juniors

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate for election has graduated from a school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Section 10.

Students

A Student shall be at least seventeen years of age, and shall present a certificate of having passed successfully an examination equivalent to the final examination of a High School or the matriculation of an Arts or Science course. He shall either be pursuing a course of instruction in a school of engineering recognized by the Council, in which case he shall not remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination equal to that prescribed for admission to the grade of Junior in the foregoing section. He shall not remain in the class of Student after he has attained the age of twenty-seven years.

Section 12.

Officers

The officers of *The Institute* shall be a President, four Vice-Presidents and thirty-three Councillors.

Section 13.

Term of Office—Vacancies

The term of office of the President shall be one year; of the Vice-Presidents two years; and of the Councillors three years. Two Vice-Presidents and eleven Councillors, in addition to any required to fill vacancies, shall be elected annually.

Section 32. (2nd paragraph)

Expulsion and Discipline

In case the Council on receiving a complaint in writing, shall be of the opinion that the conduct of any Corporate or Non-Corporate Member should become the subject of enquiry, with the view to ascertain whether there are grounds for disciplining or expelling him; or in case twenty or more Corporate Members shall think fit to draw up and sign a request for such an enquiry regarding any Corporate or Non-Corporate Member on any ground whatever, and shall deliver same to the Secretary to be laid before the Council for consideration; the Council shall first notify by registered mail, the Member against whom the complaint is laid, setting forth the charges and by whom made, and naming a date not less than six weeks from the date of such notification, for the holding of an enquiry.

If the defendant Member decides that he desires to be present in person at the enquiry, and so advises Council in writing, or by telegram, sent to the Secretary within four weeks from date of mailing the notification from Council, the Council shall rename a day for the enquiry, not less than eight weeks from date of preliminary notification, and shall notify complainants and defendant by registered mail at least four weeks previous to new date set and shall request their presence at the enquiry. Should any complainant member, after receiving due notice, fail to appear at the enquiry without having previously given reason in writing or by telegram satisfactory to Council, the Council shall demand of such delinquent member in writing by registered mail that he furnish the defendant member through Council, a written apology satisfactory to Council, or send in his resignation from *The Institute*; failing his doing so, the Council shall cause the name of such delinquent Member to be erased from the register and thus expel him.

On the final date set for an enquiry the Council shall make such inquiry as it deems adequate, the complainant and defendant members, if present, being given full opportunity for deposition and examination. Should the Council not find sufficient reasons for disciplining or expelling the said Member, no record of the enquiry shall be made in the Minutes; but, if the Council, by a majority of at least four fifths of those present at a meeting especially summoned for the purpose, and at which at least twelve Members of the Council are present, does find good reason for expelling or otherwise disciplining the said Member on the ground that he has been guilty of improper conduct the Council shall cause the name of such person to be erased from the register and thus expel him from *The Institute*; or otherwise discipline him at their discretion. The Secretary shall forthwith notify the Member of the decision of the Council and should the Member be expelled the Council shall report such expulsion at the next annual general meeting.

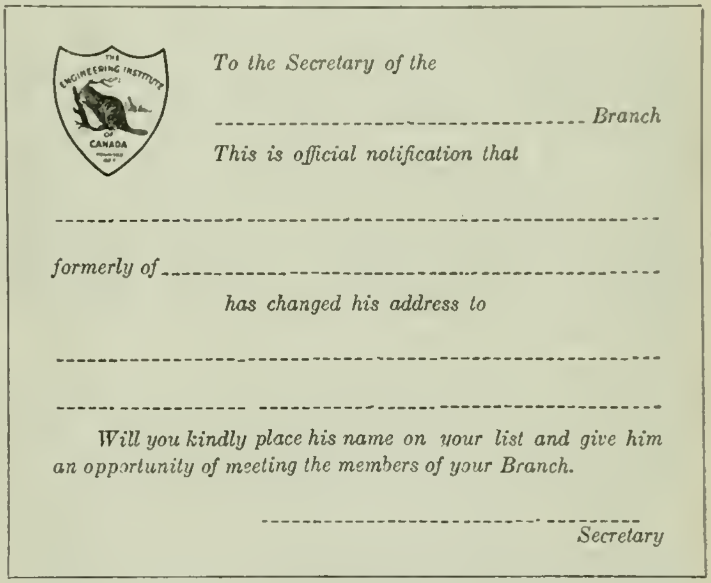
Should the complainant or defendant be a Member of the Council he shall not act as a Councillor in any matter affecting the enquiry.

No verbal or anonymous complaint against any Corporate or Non-Corporate Member shall be considered or acted upon by Council.

Membership Cards

As a result of a suggestion recently made, transfer cards are being issued to all members moving from one Branch jurisdiction to another or from non-resident localities to Branch headquarters, and a duplicate of the card issued to the member changing his address is forwarded to the Secretary of the Branch. The card is reproduced.

Change of Address Card



To the Secretary of the

________________________ *Branch*

This is official notification that

____

formerly of ________________________

has changed his address to

____

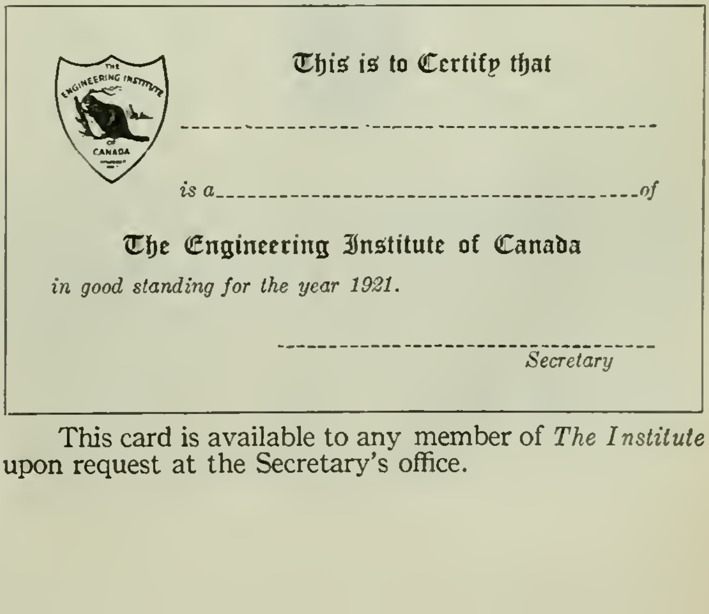
____

Will you kindly place his name on your list and give him an opportunity of meeting the members of your Branch.

________________________ *Secretary*

For the benefit of members, which includes Students, Juniors and Associate Members, a membership card has been printed, of which a reproduction appears.

Membership Card



This is to Certify that

____

is a ________________________ *of*

The Engineering Institute of Canada

in good standing for the year 1921.

________________________ *Secretary*

This card is available to any member of *The Institute* upon request at the Secretary's office.

Abuse of the Term "Engineer"

Under the caption "B.C. Engineers break away from International Union" there appeared in the Vancouver "Province" under date of March 8th, an article referring to a newly incorporated body "The Canadian Society of Certified Steam Engineers". This offence against the use of the word "engineer" is duplicated by editorial writers throughout the country almost daily. If the word "engineer" in its broad sense means anything at all it means one who practises the profession of engineering, and when applied to those who have no claim upon the word in addition to being an abuse of title, it becomes in every instance an offence against those legitimately entitled to use it.

On the continent of Europe there is no misunderstanding, as a man who operates an engine, drives a locomotive or attends a power plant is known by terms expressing what he is doing and the word "engineer" is reserved and used only in its professional sense. So great, however, has become the misapplication of the word, particularly in the United States and Canada, that it is doubtful if it can ever again be brought to be considered solely in its proper sphere. Much can be done, however, by members of *The Institute* deprecating the use of the term when applied in any other way than that of referring to those practising the engineering profession and by educating local editors and those responsible for the guidance of public opinion and further, by each one pledging himself not to use the word improperly.

It may be necessary to use the word "professional" each time but that becomes a lengthy expression. The suggestion was made two years ago that we, as professional engineers, adopt the word "ingenieur" and have it recognized by act of Parliament as applying to a professional engineer. It would take years, however, to have its adoption become universal, provided it met with the approval of the profession itself. The whole situation, however, is one to which the average engineer might well give serious thought.

Badge of The Institute

Although a photograph of the official badge of *The Institute* was published previously, it is reproduced here for the benefit of those who have joined *The Institute* within the past two years. This badge is available either as a lapel button, a pin or a watch fob. The badge for Members is gold, price three dollars and seventy-five cents, for Associate Members silver, price two dollars and twenty-five cents and bronze for Juniors and Students, price one dollar and fifty cents. The owner's name is engraved on the back together with the number of his badge.

These are available through the Secretary's office.

Providing Better Copyright Laws

The establishment of a Dominion-wide Canadian Authors' Association at the recent Convention of Canadian writers held in Montreal, should prove of considerable interest and value to many members of *The Engineering Institute of Canada* who have written articles or books of copyrightable value. One of the expressed objects of the new Association is to assist in protecting the literary property of its members and to disseminate information as to the business rights and interests of its members as authors. A Committee on Copyright has been appointed to report among other things on the Copyright Bill now before the House of Commons, a Bill which is receiving much adverse criticism, both from publishers and authors.

The very representative character of the Convention and of the officers and Council elected for the new Association augurs well for its future success. It is interesting to note that University trained men are well to the fore. John Murray Gibbon, the President, and W. S. Wallace, the Treasurer, are both graduates of Oxford; B. K. Sandwell, the Secretary, is a graduate of Toronto; out of the nine Canadian Vice-Presidents, four are University Professors, namely, Stephen Leacock (Montreal); Pelham Edgar (Toronto); Archibald MacMechan (Halifax); and W. T. Allison (Winnipeg). From this one can anticipate that the interests of authors of text books and scientific publications will receive as much consideration as authors of poetry and fiction. Membership in the Canadian Authors Association will cost $5.00, and is open to 'Any writer, dramatist or scenario writer, or other creator of copyrightable literary material of recognized position in his or her profession as Author', and Associate Membership open to those who are in sympathy with the objects of the Association, but who are not considered by the Membership Committee as entitled to rank as regular members will cost $3.00 per annum. The temporary offices of the Association are at 205 Drummond Building, Montreal. B. K. Sandwell, the Secretary, is also Editor of "The Canadian Bookman", which has the same address. Following is the complete list of Officers and Council:—

President	John Murray Gibbon, Montreal.
Secretary	B. K. Sandwell, 205 Drummond Building, Montreal.
Treasurer	W. S. Wallace, Toronto University Library, Toronto.
Vice-Presidents	Archibald MacMechan, Halifax. Rev. H. A. Cody, St. John, N.B. Stephen Leacock, Montreal. Hon. Thomas Chapais, Quebec. Pelham Edgar, Toronto. R. J. C. Stead, Ottawa. W. T. Allison, Winnipeg. (Mrs.) Nellie McClung, Edmonton. (Mrs.) Isobel Ecclestone Mackay, Vancouver. Basil King, Boston.
Président de Section.	To be appointed by French Canadian Section.

Council
Miss Grace Blackburn, London, Ont.
Bliss Carman, New Canaan, Conn.
Warwick Chipman, Montreal.
Rev. C. W. Gordon (Ralph Connor), Winnipeg.
Miss Lucy Doyle, Toronto.
Hector Garneau, Montreal.
Mrs. Florence Randal Livesay, Toronto.
W. D. Lighthall, Montreal.
Miss Agnes Laut, New York City.
Dr. George H. Locke, Toronto.
Mrs. Madge Macbeth, Ottawa.
Sir Andrew Macphail, Montreal.
Mrs. E. Macdonald (L. M. Montgomery), Leaskdale, Ont.
Louvigny de Montigny, Ottawa.
Mrs. Emily Murphy (Janey Canuck), Edmonton.
Frank L. Packard, Lachine, Que.
Miss Marjarie Pickthall, Victoria, B.C.
Lloyd Roberts, Ottawa.
Theodore Roberts, temporarily in England.
Duncan Campbell Scott, Ottawa.
Robert Service, Paris, France.
Miss J. G. Sime, Montreal.
Arthur Stringer, Chatham, Ont.

Four Members of Council to be appointed by French Canadian Section.

CORRESPONDENCE

Appreciation of "Economics of Building Design."

March 4, 1921.

Editor, *Journal:*—

Dear Sir:

Will you please convey to Mr. J. Morrow Oxley our compliments for the very excellent paper given by him at your general professional meeting in Toronto on February 2, 1921. We feel that this is one of the finest papers on the economics of building costs that we have ever seen.

We have spent considerable time ourselves in making just such a study but have been unable to complete it owing to other work, and we shall find this paper of very great value in checking our results.

Truly yours,
Lockwood, Greene & Co., *Engineers*
P. W. Taylor.

Lockwood, Greene & Co.,
Engineers
60 Federal Street
Boston.

Major Wilson in Mesopotamia

Editor, *Journal:*—

Dear Sir:—

Your letter of 12.11.20 to hand. I arrived in Mesopotamia on 1.12.20 and went up river to Baghdad and was posted as district irrigation officer of the Muntafiq Liwa, with headquarters at Nasiriyah. This district has an area of six thousand square miles but as it was the last place to be retaken from the Insurgents this winter it is still occupied by the military and only a very small portion of it can be visited yet. The country is flat in a way that would have to be seen to be understood. Twenty miles from the river bank the ground is more often than not at a lower elevation than the river and in no place that I have seen would it have risen six feet in elevation. The towns (?) are ringed round with built up earth bunds and most of the rivers are only confined to their courses in the spring floods by bunds along both banks which have to be continually patrolled during the floods, and when a bund breaks the flood waters go twenty or thirty miles out into the flat desert. The bunds are built up of earth or clay and faced with camel thorn or brushwood and are easily eaten away by the wave action caused by the wind on the surface of the river. There is no gravel or sand and only at one place in the country is there any rock to be had. I have not seen one single stone or pebble in the country. The rivers have a habit of cutting new channels for themselves and deserting the old ones and perhaps returning back again in a few years so no one likes to interfere too much with them. The Arab method of ploughing is with a timber about 7″ dia. sharpened at one end and dragged by two oxen. It only scratches the ground, most of the work is done by mattock. In low water he gets his water for irrigation out of the river in skins open at the end and neck, hoisted up by a cow with a rope over a pulley. He has no plough, no harrow, no roller, ro reaper, no carts. He cuts his crops by hand with an almost straight pruning knife about 8″ long. He grinds his grain into flour between two small flat stones and pounds his rice in hollowed out tree stems with wooden pestles.

This is the original Garden of Eden and is just as Adam left it. Except for date palms there is only one tree in Mesopotamia and that is the Tree of Life at the confluence of the Tigris and Euphrates and it is a holy shrine, kept decorated. The remains of the city of "Ur of the Chaldeans" is eleven miles from here and the brick remains of an immense building or pyramid that was built long before the time of Christ still stands and can be seen for twenty miles. I will write you some future time and let you know how I am getting along.

Yours very truly,
W. T. Wilson, *Major,*
District Irrigation Officer,
Nasiriyah.

D.I.O., Nasiriyah, Mesopotamia.

The Technical Alliance

March 18th, 1921.

Editor, *Journal:*—

Dear Sir:—

There has recently fallen into my hands, copy of a leaflet issued by the Technical Alliance, Mr. Howard Scott, chief engineer, 23 West 35th Street, New York City. On the temporary organizing committee of the Alliance, I see the name of my former associate in municipal work, Doctor Charles P. Steinmetz, chief consulting engineer of the General Electric Company, which name, in itself, is sufficient guarantee to me of the integrity of the Technical Alliance. The following definition of engineering used by them as a heading, certainly meets with my approval:

"Engineering is the science of planning and utilizing natural resources and human effort for the satisfaction of the wants of man."

Besides the pamphlet, I also have a copy of the editorial section of the New York Sunday World of February 20th, 1921, at the head of which appears the following interview of Howard Scott, chief engineer of the Technical Alliance, by Charles W. Wood, Associate Editor of the Sunday World.

"The technicians," Mr. Scott explained, "are the only group who know how people get things. They are not the only producers, but they are the only ones who know how production is accomplished. Bankers don't know. Politicians and diplomats don't know. If these fellows did know they would have got the wheels started before this. They all want production; everybody does. But those who have been running things don't know how to run them, while those who do know how have not so far considered it their business.

But the engineer recognizes that idleness is waste, that competition is waste, that duplication of effort is waste and that the unnecessary exhaustion of any natural resource is waste.

It makes no difference who owns the sun; what concerns us vitally is whether we use it properly or not. No lovers ever quarrelled about who owns the moon. Neither does it make a difference who owns the earth — if we can only discover how to use it. Ownership is a myth. If we once get to using our coal and iron and our industrial and transportation systems to their full capacity nobody will be fool enough to care whether they are owned or not.

They cannot function in labour unions as at present organized because these unions are mere political groups in which the individual member function not as an individual responsible for a certain detail of the industrial process, but as a voter expressing some — usually borrowed — opinion.

In one sense of the word, this may be called the first genuine labor organization in America; for every technician is engaged in strategically important labor and is concerned primarily with the organization — that is, the co-ordination — of industry.

Technical men must necessarily look at industry as industry. The central purpose of industry, and the only purpose which the engineer as such can pay attention to, is to serve humanity. Mr. Gantt, in his very conservative estimates, proved that our present industrial machine is not giving more than 20 per cent. of the service it is capable of giving, primarily because the machine is controlled by business groups for business ends rather than by industrialists for industrial ends.

Did they have to change human nature to keep passengers from standing on car platforms?

They put up signs first, prohibiting the dangerous practice. But the passengers still crowded on the platforms. Then they got ordinances passed and the platforms remained as crowded as before. Policemen, legislators, public service commissions, all took a hand, but to no effect. Then the problem was put up to the engineers.

The engineers solved it easily. They built cars that didn't have any platforms.

Engineers disagree as politicians, but not as engineers. We are not trying to organize them, however, into a society to debate something but into an alliance which will discover the facts. Engineers do not disagree on facts. They all know which direction a stone will drop. They all know that a straight line is the shortest distance between two points. If there is anything else they want to know as engineers, they find it out; and when they find it out, there isn't the slightest disagreement. Engineers are not radical or conservative. As engineers they are no more radical than a yardstick and no more conservative than so many degrees Fahrenheit."

The foregoing interview, while I cannot quite follow it in all its inferences, seems to me so provocative of thought amongst engineers which will be beneficial to them, that I trust you will reproduce my letter, including the quotation of this interview.

Yours very truly,

Charles A. Mullen, M.E.I.C.

Milton Hersey Co. Ltd.
Industrial Chemists, Engineers and Inspectors
84 St. Antoine Street,
Montreal.

Town Planning News and Comments

H. L. Seymour, A.M.E.I.C.

NOTE:—In order to make this column of wide interest to members of The Institute, personals and items of town planning interest will be appreciated. Address, H. L. Seymour, A.M.E.I.C., 40 Jarvis Street, Toronto.

Journal of the Town Planning Institute

Mention has already been made of the favourable reception given the first number of The Journal of the Town Planning Institute of Canada. A leading American city planner states that the issue of such a publication is another indication of how far Canada is in advance of the United States in the matter of professional town planning organization. The second number of The Journal is now in circulation and is well worth reading by all interested in planning and development work.

When the Town Planning Institute of Canada was formed a policy was adopted of having no full membership, and charter members were granted only associate membership. Twenty-five members have presented theses which have been approved by the Board of Examiners and the authors of these theses are now entitled to full membership. Of these twenty-five, thirteen are corporate members of *The Engineering Institute of Canada:*—Noulan Cauchon, L. C. Charlesworth, A. G. Dalzell, James Ewing, Stewart Howard, D. H. Nelles, George Phelps, E. H. Phillips, W. H. Powell, R. C. Purses, H. L. Seymour, Wm. Storrie and Christopher Yorath.

Ontario Town Planning and Housing Conference

As a result of the Conference held in Toronto the 17th and 18th of February a permanent Town Planning and Housing Conference has been organized with J. P. Hynes, A.M.E.I.C., Toronto, as Chairman and W.S.B. Armstrong, 307 Lumsden Bldg. Toronto, Secretary and with representatives from various Ontario cities.

During the Conference a deputation waited on the Provincial Government and presented certain resolutions. The most important request preferred was that the provisions of the City of Ottawa "Planning and Development Bill" now before the Ontario House should be made applicable to other municipalities. The present "Planning and Development Act" in Ontario gives urban municipalities control of undeveloped areas in and surrounding such municipalities as far as the subdivision of land is concerned but gives no control over building development. The Ottawa bill has been drafted to supplement the present act by granting to that municipality certain control over building development.

James Ewing, M.E.I.C., of Montreal was a welcome visitor to the Conference.

Progress of Town and City Planning in the United States

The Intercollegiate Tours of Boston, Mass., are advertising a summer civic tour to Europe. It is said that the tour is an attempt to understand the business, social and economic conditions in Europe. Town Planning and Housing are matters that are to be featured in the tour and the executive head of the group is Dr. John Nolen, town and city planner of Cambridge, Mass.

From information collected mainly by the Detroit City Plan Commission, the National Conference on City Planning has issued a book entitled "Municipal Accomplishment in City Planning and Published City Plan Reports in the United States" edited by Miss Theodora Kimball, librarian of the School of Architecture, Harvard University. According to this pamphlet there are in the United States 148 city plan commissions actually at work.

An organization termed the American City Consultants has been formed in New York. Experts in different fields including city and town planning, municipal engineering and municipal administration are to be retained. Nelson P. Lewis, President of the American City Planning Institute, and since 1902 chief engineer of the Board of Estimate and Apportionment of New York City, is chief consultant on municipal engineering. Thomas Adams, of the Commission of Conservation and President of the Town Planning Institute of Canada, is chief consultant on city and town planning during such periods as he may be available from the work of the Commission of Conservation. Frank B. Williams of the New York Bar is counsel, and Dr. W. J. Donald, formerly head of the Department of Economis in McMaster University, Toronto, is managing director. Zoning, traffic and sanitary engineering experts are also to be retained.

In Buffalo when a City Planning Committee was to be formed some two years ago, six city officials, heads of bureaus, were appointed. Harry J. March of the city engineer's staff is executive head and engineer of the City Planning Committee. Judging from the success of the Committee there is here an example that Canadian cities might well follow, because who should really know better the needs of the city than competent civic officials. The Committee were instructed to devise a comprehensive planning and zoning system for the city of Buffalo. To aid the Committee the Buffalo City Planning Association was formed representing over 100 different organizations and a membership of over 30,000 citizens. A great deal of publicity was undertaken by the Committee and Association with the result that when a City Planning measure was recently voted on a substantial majority voted in favor thereof.

Milwaukee claims to be the third largest city of the States that has put in force a zoning ordinance. The largest city is, of course, New York with an ordinance dated 1916, the next largest being St. Louis with an ordinance in 1918 and now Milwaukee with an ordinance in 1920. It is apparent that in many cities there is now not enough street area available for the operation, not to mention the storage, of automobiles that would under ideal conditions easily reach the central portion of the city. A claim is made that in Milwaukee the relation between heights of buildings and consequent floor area with the street area has been studied and planning and zoning co-ordinated so that business buildings may be readily served by a sufficient number of automobiles to adequately take care of modern requirements.

Planning and Development in Canada

It has been recommended by a Joint Committee of the Charter Commission of Montreal that a Metropolitan Commission be created for the island of Montreal.

The Montreal City Improvement League recently appointed James Ewing, M.E.I.C., Chairman of the City Planning Committee.

Spruce Falls is the name given to a new town that is to be laid out by the Ontario Government near what is at present known as Kapuskasing. The planning of the town will be carried out under the directions of provincial officials amongst whom are included Capt. F. A. Dallyn, A.M.E.I.C., provincial sanitary engineer.

In a recent issue of "Town Planning and Conservation of Life" mention is made of a questionnaire on Municipal Development which was sent to the principal cities and towns in Canada. Answers to the questionnaire were studied and dissected by C. J. Moon, A.M.E.I.C. Information valuable to municipal engineers and those interested in city development are contained in the article referred to.

A. G. Dalzell, A.M.E.I.C., has contributed an interesting article to the same publication entitled "A Contrast in City Planning." The City of Ladysmith, Vancouver, B.C. is contrasted with an equal area in Youngstown, Ohio that has been recently town planned. In Ladysmith a rectangular subdivision has given excessively steep grades and a street area of over 45% of the total area. The Youngstown area has been planned to fit the site, only 24% of the area being in streets and all streets having reasonable grades.

A proposed summer resort at the Rivière Des Mille Iles has been planned by the engineering firm of Ewing, Lovelace and Tremblay. The plan has been attractively reproduced in the recent issue of The Journal of the Town Planning Institute of Canada.

The Civic Guild is a body of citizens who for several years have given Toronto the benefit of their efforts along Town Planning lines. If amendments to the Ontario Municipal Act as proposed by the Guild are enacted municipalities will be able to pass zoning by-laws. Legislation for the widening of streets under the principle of the "Homologated Line is also contemplated.

One of the factors that made possible the zoning ordnance that was put in effect in New York in 1916 was the Fifth Avenue Association. The endeavour of this Association was to protect the retail section from the encroachment of factories that would not only be detrimental to Fifth Avenue but indirectly to the City as a whole. In Toronto the Down Town District Association, a similar organization, has in view the preserving of the character of the Down Town District as well as its improvement. The plans of the Association will, it is understood, take into consideration the matters of Town Planning and Zoning.

Toronto Group Photograph

Copies of the group photographs taken at the Annual Meeting held in Toronto, in February, may be obtained from Alex. J. McLean, 435 Spadina Ave., Toronto.

EMPLOYMENT BUREAU

To make this department more valuable it is proposed that in future advertisements of situations vacant should state salary, and give details of requirements.

Situations Vacant

Sales Engineer

One of the largest builders of automatic labor-saving machinery in the United States, with a large designing and engineering force backed by our own pattern and machine shops, desires an established engineer to represent them in the City of Montreal. Every manufacturer has work peculiar to his line where considerable saving may be effected if automatic machinery can replace hand labor. We stand back of all machines we build. To the right man we have an attractive proposition. Box 195.

Sales Engineer

Opening for sales engineers on commission, American Company, manufacturing audible signals. Box 196.

Chief Draftsman

Chief draftsman for mechanical electrical manufacturing plant in Toronto, should have usual knowledge of electric circuits and be first class mathematician on ordinary engineering mathematics. Must be a good executive, able to get work out of men and able to carry a diversity of details without overloading himself or endeavouring to do all the work himself; must be capable machine designer. Box 197.

Designers and Checkers

First class designers and checkers for mechanical electrical manufacturing company in Toronto. Box 198.

Sales Engineer

Young graduate engineer for hydraulic and electrical sales department of large Canadian firm with branches throughout the country. For first year, work will be largely of a training nature in the head office previous to sales work. Initial salary $125.00 to $140.00. Box 199.

Assistant Levellers (Dominion Land Surveys)

Twelve Assistant Levellers (Dominion Land Surveys), Season Survey Parties of 1921, Department of the Interior, at a salary of $4.00 per day for the period of engagement, supplemented by whatever bonus may be provided by law.

Duties.—To assist the chief of a levelling party on Dominion Land Survey work; to use a level for the determination of elevations along a surveyed line; to supervise the establishing of bench marks at suitable intervals and in permanent positions; to take notes of topography along a line and of all rod readings to prepare sketches and plans of completed work; and to perform other related work as assigned.

Qualifications.—Education equivalent to high school graduation; the passing of the Dominion Land Surveyors' examination for Leveller; thorough knowledge of the level; good physical condition. Applicants must be at least twenty years of age.

A rating on Education and Experience will be given from the sworn statements submitted by applicants on their application forms. To those who qualify an oral examination may be given if necessary.

Applicants must be ready to start early in April and must agree to remain on the survey to which they are appointed until the work is finished and the party discharged.

Survey Parties, 1921, Geodetic Surveys

Applications are invited to fill sixty vacancies on the Survey Parties of the Geodetic Survey for the season of 1921. These vacancies include Lightkeepers and Signallers, Senior Lightkeepers, Engineering Helpers, Engineering Clerks, Instrumentmen and Rodmen.

When filling out applications it is important that applicants should state definitely for which of the above classes they are applying and between what dates they will be available.

Articled Pupils (Dominion Land Surveys)

Twenty Articled Pupils (Dominion Land Surveys), Season Survey Parties of 1921, Department of the Interior, at a salary of $4.00 per day for the period of engagement, supplemented by whatever bonus may be provided by law.

Duties.—To act as rear chainmen of a Dominion Land Survey Party and be responsible for the accurate measurement of the survey line; to record measurements and corrections in the field book; to record topography along the line; to make readings of the barometer, thermometer, and clinometer as directed; to direct the work of the front chainman and axeman; to determine the positions of survey monuments and see that they are properly lined in; and to perform other related work as assigned.

Qualifications.—Education equivalent to graduation from high school; the passing of the preliminary examination for Dominion Land Surveyor; good physical condition. Applicants must be at least twenty years of age.

General Directions

Application forms properly filled in must be filed in the office of the Civil Service Commission not later than April 4, 1921. Application forms may be obtained from the office of the Employment Service of Canada, or from the Secretary of the Civil Service Commission, Ottawa.

Members' Exchange

Buff & Buff Transit Wanted

Wanted to purchase second-hand Buff and Buff transit with 6″ horizontal circle and full vertical circle. Box 11-A.

Watts Transit For Sale

For sale 6″ Transit, Watts non-inverting 3 screw with tripod and case $130.00 and 14″ Dumpy Level Watts, non-inverting, 4 screw with tripod and case $70.00. Both instruments in good condition. Box 12-A.

Situations Wanted

Civil Engineer

Civil engineer, 38, with fourteen years' experience as draughtsman, instrumentman and engineer in charge. Thorough training in building and bridge construction, foundation work, also in quantity surveying and appraisal work, desires position as construction engineer with corporation or as superintendent with contractors. Open for engagement at once. Full particulars of experience and reference furnished. Box 56-P.

Drawing Work Wanted

Drawing work wanted by job, contract, or piece, by two young graduate mechanical engineers who have worked together for some years. Neat, accurate and willing to work. Tracing, detailing or designing on mechanical, structural or architectural work. Free to commence May 1st. Services temporary or permanent. Box 57-P.

Civil Engineer

Engineer, 39, with 20 years experience in various branches of civil engineering desires to become associated with reliable firm of consulting or contracting engineers. Capable of designing or superintending construction and has had particular experience in installing and maintaining cost distribution systems. Box 58-P.

Foreign Service

Two engineering graduates aged 24 and 26, unmarried, returned soldiers, Canadian nationality, would like to get in touch with those concerned with a view to taking a position for a limited time in South America or Japan. Available end of May. Box 59-P.

Students

Industrial research summer work wanted by 1st year student, McGill University. Field or out of town work preferred. Fourteen months engineering lab. experience. Familiar with electricity and chemical analysis. Box 60-P.

South American Trade Connections Wanted

Graduate of McGill Transportation course speaking Spanish and having connections in Spanish American countries, wishes to hear from Canadians interested in developing trade. Box 61-P.

Mechanical Structural Engineer

Graduate engineer, age 25, wants work on live engineering project. Field and office experience. Good on estimate and planning with special training in power and test work. Detailed record of experience and education on application. Available about May 1st. Box 62-P.

Municipal Engineer

Graduate Municipal Engineer, Jr.E.I.C., age 34, married, unemployed, two years first assistant engineer, three years foundation and railroad construction, desires permanent position. Box 63-P.

Engineer

Engineer, age 48, graduate of University of Toronto. Experienced in surveying, railroading, shop construction, shop engineering, water-steel design, concrete design, wharves, etc. 12 years assistant chief engineer, Quebec Harbour Commissioners. Would do the engineering or management of small city or town, manage some production plant, investigate companies for Trust company. Box 64-P.

Civil Engineer

Civil engineer, age 28, graduate Toronto, Highway and Sanitation option; two years experience in municipal engineering and four years as an R.E. Officer overseas, during which he built one hundred miles of road for motor traffic through the mountains of Persia. Will go anywhere on road or concrete construction work with company that can offer a good future. References on request. Box 65-P.

Mechanical Engineer

Mechanical engineer, graduate, first class stationary engineer's license for Ontario, 10 years power plant experience, saw mill and paper mill, including draughting, construction and operation, capable of laying out new construction work and installing boilers, engines, piping systems and general mechanical equipment. Box 66-P.

Mechanical Engineer

Graduate mechanical engineer, J.E.I.C., age twenty-six, single, three years practical mechanical engineering experience wishes to secure employment at a reasonable salary on the engineering staff of a pulp & paper concern in order to learn the business. Best of reference. Box 67-P.

Civil Engineering Student

Third year civil engineer, S.E.I.C., desires summer work on construction or general engineering. Returned soldier. Box 68-P.

Chemical Engineer

Graduate in chemical engineering with considerable industrial experience in responsible charge, open for position. Box 69-P.

List of Student Members E.I.C. at McGill University, Desiring Summer Employment.

Name	Returned Soldier	Home address	Work desired	Experience
4th Year Civil Eng.				
Drewry, J. H.	R.S.	727 Linden Avenue, Victoria, B.C.	Surveying or highway	3 yrs. B.C.L.S. apprenticeship, 15 mos. in the field.
Farmer, R. W.	R.S.	756 University Street, Montreal, P.Q.	Municipal or construction work	
Fortin, G. L.	R.S.	191 Mance St., Montreal, P.Q.	Construction	3 mos. Dominion Bridge Co., also G.T.R. valuation.
Gauthier, P. G.		86 Pine Ave. W., Montreal, P.Q.	Construction	3 mos. Angus Shops, 6 mos. surveying, 3 mos. construction.
Chemical Eng.				
Challenger, J. O.		743 University St., Montreal, P.Q.	Chemical	14 mos. plant experience.
Cockfield, A. E.	R.S.	760 Wilder Ave., Montreal, P.Q.		4 mos. plant experience.
Cuddy, J. M.		269 Mance St., Montreal, P.Q.	Chemical or engineer'g (Montreal)	4 mos. experience.
Forbes, K.	R.S.	807 Shuter St., Montreal, P.Q.	Chemical	4 mos. plant work.
Mackenzie, D. G.		1012 Dorchester St. W., Montreal, P.Q.	Chemical or engineering. (Montreal)	12 mos. research chemistry. One summer pulp plant.
Yates, C. M.	R.S.	297 Prince Arthur St. W., Montreal, P.Q.	Steel foundry work	None.
Electrical Eng.				
Bishop, T. A. G.	R.S.	9 Summerhill Ave., Montreal, P.Q.	Electric'l eng'g., pref. traction	
Hill, S. C.		Richmond, P.Q.	Electrical	
Jackson, C. H.		2127 Jeanne Mance St., Montreal, P.Q.	Electrical	4 mos. power plant.
Whelen, M. P.	R.S.	260 Somerset St., Ottawa, Ont.	Industrial or electrical engineer'g.	7 mos. construction work.
3rd Year Civil Eng.				
Cousineau, C. A.		2733a Drolet St., Montreal, P.Q.	Instrument man or any civil eng. work	4 mos. general construction and 4 mos. instrument man.
Delaney, W. V.		Wolfville, N.S.	Hydraulic	Four summers plane table, chaining and rodding.
Fisk, G. H.		166 Drummond St., Montreal, P.Q.	Bridge construction or concrete	3½ mos. machine shop, and 2 mos. machine and shell work; 3 mos. B.C. Geological Survey.
Hamel, A.		50 Notre Dame St., Three Rivers, P.Q.	Pulp and Paper Mill construction or operation	Three mos. paper mill construction; 3 mos. survey.
Wilder, H. B.	R.S.	680 Roslyn Avenue, Westmount, P.Q.	Construction work or surveying	3 mos. time clerk and cost keeping, wireless operator 3 yrs.; shop-work 5 mos.
Chemical Eng.				
Ahern, A. W.	R.S.	8 St. Denis Ave., Quebec, P.Q.	Chemical	2 mos. Standard Chemical Co; Formaldehyde and refrigeration.
Brooks, C. L.	R.S.	4025 Dorchester St., Westmount, Montreal, P.Q.	Pulp and paper, or any chemical engineering	4 mos. chemical engineer'g., 4 mos. Montreal Harbour Comm., 5 mos. construction work.
Carson, C. E.		465 Strathcona Ave., Montreal, P.Q.	Chemical (Montreal)	3 mos. formaldehyde manufacture.
Drummond, R. N.		2695 Rosemount Blvd., Montreal,	Industrial chemistry	3 mos. steel & iron analysis.
Farquharson, J. S.	R.S.	153 Stanley St., Montreal	Pulp and paper or chemical	
Loebel, J. M.		P.O. Box 364, Stn. B, Montreal	Chemical laboratory	
Woodward, E. R.	R.S.	541 Dorchester St. W., Montreal.	Chem. eng., pulp and paper pref.	4½ yrs. railroad construction and location in Canada, and military mining in France.
Electrical Eng.				
Anderson, D.	R.S.	289 Richmond St., Charlottetown, P.E.I.	Testing or outdoor	5 mos. electrical.
Armstrong, L. H.	R.S.	845 Oxenden Ave., Montreal.	Electrical construction or repair work	Wireless operator ten mos, experience with different types of apparatus.
Banfill, H. L.	R.S.	Richmond, P.Q.	Electrical, pref. power plant	
Bonneville, S.	R.S.	630 Dorchester St. W., Montreal.	Electrical	4 mos. coil winder.
Kerr, G. E.		Fernie, B.C.	Electrical or survey	One summer surveying, and one summer transformer winding.
Mott, H. E.	R.S.	150 Brant Ave., Brantford, Ont.	Electrical constrn. or installation, near Toronto	One summer with Hydro-Electric Power Commission of Ontario. etc.

List of Student Members E.I.C. at McGill University, Desiring Summer Employment.

Name	Returned Soldier	Home address	Work desired	Experience
Mechanical Eng.				
Crawford, R. E		410 Mance St., Montreal	Draughting	4 mos., Angus Shops, car draughting; 15 mos. helper, loco. fitting, 5 mos. foreman's clerk, 13 mos. bank clerk.
Bastable, R. W		96-44th. Ave., Lachine, P.Q	Mechanical dept	3 mos. shop experience, 4 mos. drafting.
Potter, John B		Springhill, N.S	Machine shop or engineering	2 yrs. and 6 mos. engineer'g office.
Mining Eng.				
Davis, S. H	R.S.	McGill Union, Montreal	Geological or mining	
Humes, H. L	R.S.	4288 Western Ave., Montreal	Fieldwork, geology or metallurgcl.	4 mos. computer Rly. Eng. Dept.
McClelland, W. R		25 Coburg Rd., Halifax, N.S	Metallurgical	4 mos. acting chief chemist.
Pevzner, I		86 Laurier Ave. W., Montreal	Metallurgical	15 mos. munitions inspection.
Wightman, J		Digby, N.S	Mining, any kind	
2nd Year				
Armstrong, A. V		845 Oxenden Ave., Montreal	Electrical	6 mos. experience.
Bieler, J. L		223 Milton St., Montreal	Machine shop, mechanic'l draw'g.	4 mos. in construction and millwright work.
Binns, Geo. F		261 Melrose Ave., Montreal	Mechanical	36 mos. experience.
Bradshaw, F. W		823 University St., Montreal	Chemical	6 mos. engine detail machinery.
Bradshaw, G. R		102 Silica St., Nelson, B.C	Work in mine	2 mos. mucking in mine.
Brisbane, W. G	R.S.	452 Strathcona Ave., Westmount	Civil eng	
Brumell, J. H		Buckingham, Que	Surveying	12 mos. as mechanic in garage; general repair work in chemical plant.
Buller, F. H		147 Bishop St.. Montreal	Electrical. shop or drafting	No experience.
Caldwell, C. E	R.S.	291 Sherbrooke St. W., Montreal.	Mechanical	4 mos. air compressor attendant.
Gregeen, K. T		1 Metcalfe St., Montreal	Electrical	4 mos. experience.
Culpeper, B. A	R.S.	2587B Mance St., Montreal	Surveying on construction	3 yrs. transit, level and mapping experience.
Dalrymple, E. R		617 Carlton Ave., Westmount	Hydro-electric	4 mos. draughting.
De Salaberry, B	R.S.	196 Park Ave., Montreal	Chem. or pulp and paper mill	5 mos. in pulp and paper mill.
Dickinson, A. G	R.S.	914 21st Ave. W., Vancouver, B.C.	Electrical power construction or maintenance in Western Canada	4 mos. experience.
Dormer, W. J. S	R.S.	Lennoxville, Que	Power house operation or floorman	3 mos. testing meters; 4 mos. lineman on transmission line.
Eadie, T. W		1321 Wellington St., Ottawa, Ont.	Construction	6 mos. as rodman and instrument.
Elkington, G. E	R.S.	297 Prince Arthur St. W., Montreal	Hydro-electric power plant or electro-chemical works	
Fagan, J. W	R.S.	1899B St. Catherine St. E., Montreal	Pulp and paper industry	
Gilbert, E. V	R.S.	443 Bleury St., Montreal	Survey work or highway constrn.	4 yrs. sapper Can. Engineers; 4 mos. chaining and rodman.
Goldberg, H. J		673 St. Lawrence Blvd., Montreal	Outside work, pref. electrical	No experience.
Hamilton, G. J		287 Mountain St., Montreal	Industrial plant, mech. eng'g	
Horsey, R		1729 De La Roche St., Montreal.	Electrical	4 mos. experience.
Jackson, L. W	R.S.	447 Daly Ave., Ottawa, Ont	Electrical	2 mos. at Nickel Refinery.
LeBaron, K. S	R.S.	851 University St., Montreal	Railroad engineering	7 mos. drafting locomotives.
Leitch, H. J		476 Strathcona Ave., Westmount, Que.	Railway or construction	3 mos. Bridge Section, G.T.R., Arbitration Board.
McKindsey, G		Lennoxville, Que	Structural drafting	3 mos. machine drafting.
Morin, C. A		2719 Christophe Colomb, Montreal	Chemical or surveying	6 mos. surveying and drafting.
Munro, D. J	R.S.	2299A Hutchison St., Montreal	Electrical	4 mos. electrical work.
Owens, O. N. H	R.S.	26 Summerhill Ave., Montreal	Any work in which experience may be gained.	3 mos. in foundry; 10 mos. in bush and around lumber mill.
Peters, A. W	R.S.	50 Chesterfield Ave., Westmount, Que.	Survey or outdoor electrical	Summer maintenance of way; 5 mos. Canadian Westinghouse (transformers).
Spriggs, R. H		c/o J. W. Hayward, Box 111, Ste. Anne de Bellevue, Que., or 34 McGill College Ave., Montreal.	Assistant on survey party	3 mos. with geological survey topographical work.
Taylor, C. W		Carberry, Manitoba	Steam engineering	5 mos. fireman, S.S. Wolverine, Lake Winnipeg; 4 mos. relieving engineer and house wiring.
Toole, F. J	R.S.	53 Hutchison St., Montreal	Chemical industry	No experience.

The Engineering Society of Queen's University announces the establishment of a permanent Employment Service. It will give employers of technically trained men complete and reliable information regarding graduates and undergraduates.

Listed below are some of the students desirous of obtaining employment in May. Almost all have expressed their willingness to do manual work along their chosen lines. Full information regarding any of these men can be obtained, promptly, from, The Manager, Queen's Engineering Society, Employment Service, Kingston, Ont.

List of Students at Queen's University, Desiring Summer Employment.

Name	Work Preferred	Experience
Chemistry & Metallurgy 3rd Year		
Hamilton, A. G.	Chemical lab. or plant	4 mos, chemical plant.
MacFarlane, W. J	Steel plant	3 mos. surveying; 4 mos. assistant chemist sulphite lab.; 3 yrs. overs's.
VanPuskirk, J. E	Process control, lab. or assay office	3 mos. paper mill; 6 mos. electrical assembly transformers; 3 mos. foreman acetic acid manufacture.
McLean, W. A.	Chem. lab. or plant work	1 yr. overseas.
Farquharson, R. J.	Steel plant, smelter or assaying	1 yr. municipal work; 4 mos. electric steel plant; 1 yr. inspector I.M.B.; 2 yrs. R.A.F.
Searle, H. E.	Metallurgical or chem. plant	4 mos. foreman and analyst electro-chemical plant; 2 yrs. elec. exp.
Bleakney, H. H.	Metallurgical or mill work	5 mos. process man in nickel refinery.
McIlraith, E. F.	Metallurgy, mill or refinery	5 mos. nickel refinery; 2 yrs. R.A.F. (D.F.C.).
2nd Year		
Griffin, H. S.	Metallurgical or chemical plant	5 mos. chemical plant; 3 yrs. manufacturing and executive work.
Stewart, D. W.	Metallurgc'l plant or pulp & paper mill	....
Kidd, E. E.	Pulp & paper or mill or mill work	....
Anderson, L. C.	Pulp & paper mill	6 mos. transitman water power survey; 3 yrs. overseas, (M.M.).
McMullen, W. B	Lab. work	1½ yr. nickel smelter.
Cardiff, J. C	Metallurgical or chemical plant	....
Wagar, E.	Chemical plant	5 mos. concrete inspector; 42 mos. overseas.
Chesser, A. M.	Metallurgy	2½ yrs. mining and milling.
1st Year		
Patterson, W. E.	Junior chemist	14 mos. lab. (explosives, cyanamid and steel).
Mining Graduating Class		
Marshall, I. M.	Metallurgy or mining	1 yr. development work; 2½ yrs. underground & milling; 6 mos. geological survey; 3 yrs. C.E. overseas, (M.C.).
Smith, F. M	Mining or metallurgy	2 yrs. underground; mill work & asst. mine surveyor; 4 yrs. R.G.A overseas.
1st Year		
Williams, L. F.	Surveying or mining	5 mos. chainman; 5 mos. underground; 4 yrs. overseas, P.P.C.L.I. & R.A.F.
Swartman, G.	Mining	4 mos. asst. chemist; 4 mos. instrumentman; 5 mos. quarry work.
2nd Year		
James, V. A.	Instrumentman	4 mos. underground; 4 yrs. shop work; 3 yrs. overseas.
Douglas, J. M.	Mining or metallurgy	....
Civil Graduating Class		
Barrett, A. G.	Construction or highway work	10 mos. geological survey; 3 mos. municipal work; 1 yr. overseas.
Bonham, R. L.	Construction or municipal work	5 mos. instrumentman on irrigation survey; 41 mos. overseas.
Cobb, C. E.	Municipal or highway work	1 yr. foreman on municipal work; 6 mos. concrete construction, 6 mos. chainman.
Meadd, H. E.	Municipal or construction work	1 yr. chainman and instrumentman on power development; 1 yr. overseas.
Armitage, H. F.	Structural or highway work	5 mos. geological survey; 5 mos. highway inspector.
3rd Year		
Emrey, D. J	Construction	4 yrs. foreman reinforced concrete construction, railroad, surveying, drafting; asst. eng. G.T.R. Arbitration; 4½ yrs. overseas, in C.E. (M.C., M.M.).
Walker, G. S.	Highway or railway work	4 yrs. assistant to D.L.S.; 1 yr. N.T.R. cross section; 4 yrs. overseas C.E.
Greenwood, W.	Waterpower or highway work	6 mos. geological survey; 2 yrs. overseas.
Deamude, F. V.	Structural, reinforced concrete or municipal	7 mos. topographical survey; 3 mos. reinforced concrete; 5 mos. railroad location; 5 mos. machine shop; 2 yrs. overseas.

List of Students at Queen's University, Desiring Summer Employment.

Name	Work Preferred	Experience
Civil Graduating Class 2nd Year		
Tompkins, J	Construction or drafting	6 yrs. bldg. construction & mill. supt.; 2½ yrs. overseas.
Holdcroft, W. P. R	Surveying or construction work	4 mos. surveying on railroad const.; 4 yrs. R.E. overseas, (M.C.).
Chalmers, A. E.	Surveying or highway	2 mos. road inspector; 2 mos. calculator for bridge co.
1st Year		
Rousell, F.	Construction work	4 mos. highway inspector; 4 yrs. overseas.
Mechanical Post-Graduate		
Hudson, G. W.	Test work, teaching power plant work	3 yrs. shop and drafting; 1 yr. designer; 1 yr. demonstrator in Physics and Engineering.
Graduating Year		
Isaac, V. W.	Industrial, power plant, paper mill wk.	3 yrs. construction; 1 yr. machinist; 1 yr. mill drafting; 1 yr. industrial engineer; 5 mos. paper mill installation design.
Legault, A. J.	Paper mill	2 yrs. drafting; 3 yrs. shop work; 5 mos. underground; 15 mos. overseas, in C.E.
Ellis, F. J.	Power plant, installation, auto assembling	18 mos. D.L.S. asst.; 5 mos. concrete inspector; 6 mos. chief of survey party; 4 yrs. overseas, in R.A.F.
Fahey, J. V	Hydraulic eng.	1 yr. hydrographic surveying; 7 mos. overseas.
McConville, C. A.	Locomotive manuf. rubber tire manuf.	5 mos. planning man in rubber factory; 4 mos. locomotive shop; 5 mos. ship-building yard; 5 mos. machine & shell shops; 18 mos. overseas.
3rd Year		
Young, J. P.	Estimating, mech. drafting, mach. designing	3 yrs. in machine shop; 1½ yrs. mechanical drafting office; 3 yrs. overseas.
Roy, E. W.	Production or auto. engine design	3 yrs. machinist; 5 mos. asst. to chief inspector in machine shop.
Clench, R. J	Drafting	6 mos. machine shop; 6 mos. shell inspector; 3 yrs. R.A.F.
Wilson, D.	Drafting or const.	6 mos. automobile repair; 5 mos. geological survey; 5 mos. shop work.
2nd Year		
Askin, R. J	Machine design, foreman in plant	5 yrs. machine shop, construction, machine repair, millwright, drafting in car plant; 1 yr. bolter-up foreman and mold loftsman in shipyard.
Hay, M. N.	Drafting, mech. work	1 yr. auto factory; 9 mos. railroad shops; 2 yrs. garage; 3 yrs. overseas.
Minnes, V. A.	Machine shop	2 mos. transmission work; 4 mos. motor assembly & repairs; 6 mos. shipbuilding yard; 2 yrs. overseas.
Hipwell, J. E.	Machine shop	2 yrs. automobile factory; 3 yrs. overseas.
Dawson, W. A.	Asst. to mech. eng. tool room work	5 yrs. tool & die-maker on Naval Ordnance work.
Lewis, W. M.	Shop work, or power plant	7 mos. shell inspector; 6 mos. oiler and asst. eng. on boat.
Davison, C. F.	Shop work	4 mos. car works; 4½ yrs. overseas.
Electrical 2nd Year		
Jones, V. C.	Designing motors & generators	7 mos. drafting, motors and generators; 2½ yrs. overseas.
Baker, A. J.	Hydro const., street ry. work	2½ yrs. machine shop; car-barn work, wiring.
Naylor, J. B	Electrical work	5 mos. machine shop; 3½ yrs. overseas.
Ross, D. C.	Electrical work	2 mos. wiring; 4 mos. drafting.
Collyer, E.	Power house	6 mos. in power house; 15 mos. overseas.

LIBRARY NOTES

During the last few months a number of valuable text-books have been presented to *The Institute*; of these a brief review follows:—

Industrial Oil Engineering, by J. R. Battle, Vol. 1, Industrial Oils and Lubrication, published by J. B. Lippincott, Philadelphia. $10.00 per volume. 1000 pages.

After introductory sections of mathematics, mechanical engineering and marketing, which are naturally somewhat compressed, the principal subject of the book is taken up in a series of sections: Petroleums, Shale Oils, Lubricants, Testing Oils, Lubrication in general, Bearings, Filters, etc. A section of almost 500 pages deals with industrial practice and utilization of lubricating oils and industrial oils under the various headings of: Air Compressors, Automobiles, Diesel Engines, Heat Treatment, Mining, Pneumatic Tools, Railways, etc.

Spot and Arc Welding, H. A. Horner, published by J. B. Lippincott Company, Philadelphia. 300 pages.

The first section of the book deals with spot-welding; including a demonstration of heavy spot welding by the Emergency Fleet Corporation. The second part of the book on arc welding, gives a general description of the process with a discussion on the relative merits of the bare and covered electrode. Following a chapter on the welded ship the author discusses theories of electric welding, and concludes with a number of appendices, including a series of lessons in arc welding issued by the Lincoln Electric Company.

Hydraulic Tables, Gardner S. Williams, Allen Hazen, published by John Wiley and Sons, New York. 115 pages, $2.00

Third edition of a well known reference book, contains tables of flow in cast-iron, riveted steel, wooden-stave, pipe, etc, also tables of flow over weirs, etc. The material in the original edition has been brought up to date, a special chapter giving modern adaptations of the Williams-Hazen formula with a plate showing graphically the relations of the most important results both new and old.

Standardization of Mining Methods, Charles A. Mitke, published by McGraw-Hill Company, 239 W. 39th. St., New York. 110 pages.

One of a series of text-books on various phases of mining issued by the McGraw-Hill Company, and largely reprinted from articles appearing in the Engineering Mining Journal. Standardization of all details in connection with mining operation is strongly urged, the seven chapters covering: Standard Raises, Standard Machine-Drill Round, Ventilation of Metals Mines, Explosives, Fire Protection for Metals Mines, Standard Equipment, Prospecting and Development.

Steel Highway Bridges. Three copies of the "General Plans for Steel Highway Bridges" issued by the Department of Public Highways, Ontario, W. A. McLean, M.E.I.C., Deputy Minister of Highways, and George Hogarth, M.E.I.C., Chief Engineer, have been received at the headquarters of *The Institute* for the benefit of the members.

The publication includes 31 plates 10″ x 24″ inch, showing the details of various highway bridges from 20 ft. span to 120 ft. span from centre to centre.

Fire Tests of Building Columns — By Associated Factory Mutual Fire Insurance Companies, The National Board of Fire Underwriters, and the Bureau of Standards, published by Underwriters Laboratories Inc., 207 E. Ohio St., Chicago, Ill.

As noted in the title, this book of 390 pages is the official production of the combined fire insurance companies of the United States it is stated to be by far the most complete of its kind ever undertaken, and contains information and data not hitherto published. The general plan of the book is as follows: Description of Columns, Schedule of Tests, Placing of Coverings and Concrete Columns. Auxiliary Tests of Materials, Description of of Furnace and Related Equipment, Temperature Measurements, Deformation Measurements, Method of Testing. Results of Fire Tests, Results of Fire and Water Tests, General Summary and Discussion.

Standard Requirements for Single-phase Distribution Transformers. — Published by Canadian Engineering Standards Association, Ottawa, R. J. Durley, M.E.I.C., Secretary.

Publications of the American Society of Mechanical Engineers

Members are reminded that publications of the A.S.M.E. are now available to *Institute* members at special rates. These include: "Mechanical Engineering", (Journal of the A.S.M.E.), Transactions, Yearly Volume of the Engineering Index, The Boiler Code, Power Test Codes, and a large number of papers and discussions available in pamphlet form. Full particulars of prices, etc., may be obtained from the American Society of Mechanical Engineers, 29 W. 39th. St., New York.

OBITUARIES

Memoir of William Archibald Duff, M.E.I.C.

(Omitted from Journal, March 1920.)

Sincere regret has been expressed, particularly in the Western Provinces where he was so well known, on account of the death of the former Chairman of the Winnipeg Branch and a prominent member of *The Institute*, William Archibald Duff, M.Sc., M.E.I.C., at the age of forty-six years.

The engineering profession has suffered a sincere loss in the death of Mr. Duff as he was always keenly interested in the profession's welfare.

The late Mr. Duff was born in Montreal, in September 1874. He was educated at Highbury House School, St. Leonard's-on-Sea, England, and at the Montreal High School where he was Medallist on the Science side in the Fifth and Sixth Forms. He entered the Applied Science Faculty of McGill University in 1890 and graduated with honours as B.A.Sc. in Mechanical Engineering in 1894. He worked for some time with the Laurie Engine Company of Montreal and later with the Metropolitan Street Railway Company of New York. He took Post Graduate work at Columbia University in Electro Chemistry in 1897-1898, receiving a Master's degree in the latter year. He then engaged in building and organizing the plant of the Ottawa Carbide Company at Ottawa, and from thence went to the Westinghouse Company at Pittsburgh, Pa. In 1903, when the Westinghouse interests opened the Canadian Westinghouse Company Limited office in Montreal, he was appointed assistant manager, which position he held for seven or eight years until he was appointed to take charge of the Winnipeg office of that company. The business in Manitoba and the Western Provinces developed and increased under his direction and branch offices were opened at Calgary and Edmonton. He retired from the Canadian Westinghouse Company Limited through ill health in 1919 and died at Montreal on February 23rd, 1920. In addition to being a member of *The Engineering Institute of Canada* he held membership in the Engineers' Club of Montreal, the Manitoba Club and Country Club of Winnipeg.

*

Miles O'R. Duff, Jr.E.I.C.

Miles O'R. Duff was taken seriously ill over a year ago and died on the 9th of February, 1921. Mr. Duff had not been in good health for a number of years and his last and fatal illness was in the nature of a relapse. Mr. Duff was born in the Township of Barton, Ont., in 1885 and was educated at Public and High Schools in Hamilton, before taking a civil engineering course at the University of Toronto. He graduated in 1911 and was employed as structural draftsman with the Hamilton Bridge and Dominion Bridge Companies. Mr. Duff was a clever mathematician and if he had retained good health, would have made his mark in engineering profession. He was elected a Student Member in May 1907, and was transferred to Junior in 1913.

PERSONALS

F. H. Peters, M.E.I.C., formerly of Calgary is now resident in Ottawa.

*

Gerald O. Case, A.M.E.I.C., formerly of Georgetown, British Guiana, is at present in London, Eng.

*

W. deS. Wilson, A.M.E.I.C., has been appointed manager of the Cookshire Plant of the Standard Chemical Co. Ltd., at Cookshire, Que.

*

J. A. Creasor, J.E.I.C., recently at Port Colborne, Ont., is at present construction engineer with the Canada Cement Co., at Lakefield, Ont.

G. L. Stephens, A.M.E.I.C., has been appointed engineer officer of H.M.C.S., Patrician, and is at present with the Patrician, at Esquimault, Ont.

*

C. A. Morris, A.M.E.I.C., formerly with the Northumberland Paper and Electric Co. Ltd., is now with the Canadian Paperboard Co., at Frankford, Ont.

*

Edwin E. H. Hugli, J.E.I.C., has accepted a position as structural engineer, of the electrical department of the Hydro-Electric Power Commission of Ontario.

*

W. L. Mackenzie, S.E.I.C., formerly with the Kipawa Paper Co. Ltd., has accepted a position in the engineering department of the Welland Ship Canal at St. Catharines, Ont.

*

Bernard H. Hughes, S.E.I.C., has recently been appointed assistant engineer, Nigerian Eastern Railway Construction with headquarters at Port Harcourt, West Africa.

*

Francis Hankin, A.E.I.C., was the lecturer at the St. James Literary Society, Montreal, on March 17th, when he delivered a lecture on Rupert Brooke, the well known English poet.

*

George F. Richan, M.E.I.C., formerly divisional engineer of the Greater Winnipeg Water District, is now with the Reclamation Service of the Department of the Interior, Ottawa.

*

George Coutts, A.M.E.I.C., recently good roads engineer, at Bertile, Man., has been appointed assistant engineer, Department of Railways and Canals, Trent Canal, Peterborough, Ont.

*

F. H. Kester, A.M.E.I.C., formerly acting designing engineer with the Canadian Bridge Co. Ltd., Welland, Ont., has been promoted to the position of construction engineer with the same company.

*

Archibald O. Powell, M.E.I.C., has recently formed partnership with Joseph Jacobs in consulting engineering as the firm of Powell and Jacobs; they will specialize on irrigation in general hydraulic engineering work and will open an office in the Thompson Building, Seattle, Wash.

*

W. H. Winterrowd, A.M.E.I.C., delivered a lecture on "The Removal of Snow from Railroads" at the Mechanical Club of McGill University on February 23rd. Mr. Winterrowd is an authority on the subject and has written articles dealing with the snow removal problem as it affects railways in the technical press both of Canada and the United States.

Norman M. Campbell, A.M.E.I.C., managing director of the General Combustion Company of Canada, Limited, has made arrangements, on behalf of his company, with T. H. Watson & Company, of Sheffield, England, to build and sell their various electric furnaces, which includes the Canadian rights for the Greaves-Etchells type of furnace. He has also made arrangements whereby the General Combustion Company of Canada, Limited, has taken over the design of the Electric Furnace Construction Company of Philadelphia.

*

New Chairman of Ontario Provincial Division

Lt.-Col. W. H. Magwood, M.E.I.C., who has recently been elected Chairman of the Ontario Provincial Division was born in Perth County, Ont., in 1870 received his engineering training under T. H. Wiggings, C.E., and F. D. McNaughton, C.E. After experience on survey work in Ontario, including work on the survey and construction of the Ottawa and New York Railway, he set up in business alone, specializing in municipal engineering. Later the firm of Magwood and Walker was formed, Col. Magwood becoming a member of the firm of Magwood and Stedwill in 1912; he had varied experience in municipal and railway work, being engaged in connection with the construction of reinforced bridges and buildings, sewage disposal works, etc. Joining the C.E.F. in August 1915 Col. Magwood was with the forces in Canada, England, and France with the 77th., 154th. and 28th. Battalions (Infantry). Since returning to Canada he has been appointed town engineer for several rural municipalities in Eastern Ontario and is actively interested in various sanitation and other projects in this district. Col. Magwood has been an enthusiastic worker for the Ontario Provincial Division since its formation, and is assured of the active support of all Ontario members during the coming year.

Lt.-Col. W. H. MAGWOOD, M.E.I.C.

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New Vice-President

Henry Girdlestone Acres, M.E.I.C., hydraulic engineer of the Hydro-Electric Power Commission of Ontario, was elected on special nomination, Vice-President of *The Engineering Institute of Canada* for 1921 and 1922.

Born on May 1st, 1880, at Paris, Ontario, and after entering the School of Practical Science, Toronto, he graduated in 1903. Immediately after leaving college he joined the staff of the Elder-Dempster Steamship Company, as supernumerary engineer on one of their vessels travelling between Montreal and Liverpool and, at the close of the navigation season, accepted a post with the Canadian Niagara Power Company, first with the field engineering staff and later as assistant mechanical engineer. In this capacity he was in charge of the installation of units Nos. 1 and 2, and has the distinction of being the first engineer to bring up to speed the first 10,000 h.p. unit ever installed.

HENRY GIRDLESTONE ACRES, M.E.I.C.

Early in 1905, Mr. Acres joined the staff of the Arizona Company, as assistant engineer on railway and tunnel work and the design of engineering plant.

In the fall of the same year, he received a call from the late Cecil B. Smith, at that time chief engineer of the newly formed Hydro-Electric Power Commission of Ontario, and since that time Mr. Acres has been associated with the Commission, at first in charge of surveys of Ontario water powers and latterly as hydraulic engineer in responsible charge of the design and construction of many hydro-electric plants in Ontario, including Wasdell

Falls, Eugenia Falls, High Falls, Nipigon, Ranney Falls, the Queenston-Chippawa Power Development, and extensions of South Falls, Big Chute, Healy Falls and The Ontario Power Company.

During the period of his connection with the Commission, Mr. Acres has gained such knowledge as to make him the premier authority on the water powers of the Province and on account of the information at his disposal he was of great service in connection with the preparation of the Canadian case in international controversies presented to the International Joint Waterways Commission.

His work in responsible charge of the Queenston-Chippawa Power Development, which is unique, not only in the magnitude of the scheme but also in the original and effective methods employed in construction, places him in the forefront of engineers in modern practice in hydro-electric work.

In *Institute* matters he has supported quietly and effectively every movement to advance the status of the engineering profession. As a member of the executive of the Toronto Branch and of the Ontario Provincial Division, and in his efforts to mobilize the engineering profession during the late war, he did a large amount of work without expectation of recognition.

Mr. Acres received the degree of M.E. and E.E., Toronto University, in 1916. He is a member of the American Society of Civil Engineers and of the American Institute of Electrical Engineers, the Phi Kappa Pi Fraternity and the Engineers' Club of Toronto.

BRANCH NEWS

Vancouver Branch

J. N. Anderson, A.M.E.I.C., Secretary-Treasurer.

A meeting of the Vancouver Branch was held in the Board of Trade Auditorium on Friday, 25th February, Major G. A. Walkem, M.E.I.C., being in the Chair and over sixty members and visitors present.

This meeting was called as a general meeting, but owing to the number of visitors, including several ladies, no business was transacted.

Capt. T. W. Fairhurst, R.E. (R.O.), A.M.E.I.C., delivered a most interesting lecture, illustrated by lantern slides, his subject being "The Water Supply across the Sinai Desert for the Palestine Expeditionary Force".

Capt. Fairhurst commenced with a geographical description of the country between Northern Syria and Western Egypt, including a graphic layout of the Suez Canal with its stations.

The lecturer went on to describe the original scheme for watering canal advance posts in the early days of 1915 by means of tank barges and tugs. In 1916, following upon the abandonment of all but one of the lines of advance towards the Turkish army, concentration began at El Kantaira, where water filtration and storage were provided for the small body of troops then concerned. Later, as they advanced from this point northward (the real Palestine advance) a broad gauge railroad was started to follow the line of advance, and construction was begun on filtration plant to handle, at least, one million gallons per day; re-inforced concrete reservoirs every 25 miles through the desert and a 12" weldless steel pipe line were constructed from Kantaira to a place called Sheikh Nuran, which is a few miles short of Beersheba, a total distance of 200 miles.

At each of the storage points, previously mentioned, heavy duty oil engine driven pumping machinery was installed and eventually ran for 2½ years without breakdown. The aggregate horse power of these stations was about 3000, and these stations, together with filtration plant and the 200 miles of 12" main, which now stands as an engineering monument to the advance across the Sinai Desert, were carried out, run and maintained by the 360th Company of the Royal Engineers, commanded by Capt. Fairhurst. It says much for the loyal work of the men concerned that during the whole of this time there never was a breakdown which caused the water supply more than forty-seven minutes stoppage, and this, only once. The total cost of this undertaking approximates to $5,000,000.00 and will remain as a permanent work for the maintenance of the Palestine military railways, which have now acquired historic fame as the last link to be made up in the over-land route from Cairo to Calais, which is now an accomplished fact.

Calgary Branch

A. L. Ford, M.E.I.C., Secretary-Treasurer.

On Friday, February 25th, Professor John A. Allan of the University of Alberta, addressed the Calgary Branch and their guests, the Mining and Metallurgical Institute, Professional Institute of the Civil Service, and Architects. He spoke on "The Petroleum Situation", and his talk, very ably presented, was given practically without notes, and covered the ground most comprehensively.

By way of introduction, a graph was shown illustrating the rapid increase in annual production of petroleum the world over, with the comment that consumption, particularly of the lighter constituents, is increasing more rapidly than production. Consequently, the eyes of the world are turned toward new possible fields of production.

An examination of the present sources of petroleum shows that the U. S. is producing 62 per cent of the world's supply. Estimates based on the present production curve and on supplies now in sight indicate that the United States supply will be exhausted in 17 years.

The problem of finding where oil exists is a laborious one, and one of the factors in the correct and economical solution of the problem is a general and detailed geological examination of the country, accompanied by reports, maps and cross sections resulting from the examination. Owing however, to the thick blanket of glacial drift over great portions of the province, the geologist is unable to see and examine the structure, and the only way of discovering the structure is by use of the drill. Unfortunately the results of drilling are seldom made available to public information. While a requirement was at one time made that all drillers should send samples of material taken from their wells properly labelled with depth etc. to the Geological Survey at Ottawa, there has been no machinery for enforcing the rule.

The geological structure of Alberta may be likened to a saucer. The strata that may be expected to contain oil rise at the West until in the inner foothills they appear at the surface. Farther East, they are believed to lie at a great depth, and at the Eastern side of the province, at least in certain places, they rise much nearer to the surface.

About the only field that has been proven in Alberta is that in the neighborhood of Okatoks on Sheep river. In 1919 it produced 16,437 barrels and in 1920, 11,718 barrels. Prospecting is going on farther South in the same general geological structure as far as Willow creek.

Farther North on the Eastern side of the province, wells are being sunk near Monitor, and Czar, South West from and near Irma.

A field West of Edmonton in the foothills has been suggested which is supposed to contain great quantities of oil. The story originated with the man who started the flurry. He knows that oil is there in this district and as inside information it is passed on to you. Some years ago this man knew a squaw quite intimately. She told him that one day he would become very rich through oil and that the oil was flowing in a great river under some land he would own, and she pointed out the place to him. For years the saying lay dormant in his brain until one night he had a dream and recalled the prophecy. With such good authority for the existence of a river of oil, he filed on the plot the squaw had indicated, and there you are. Why employ a geologist?

Farther North is the lower Peace River field. This is not a large field as the valley is 750 feet deep and very narrow at the bottom. In order to avoid drilling an additional 750 feet, wells must be located in the bottom of the valley, which is very narrow. Some wells have had very good indications, but in each case gas and salt water has given great trouble and this difficulty has not yet been successfully overcome. In the Peace River block and adjoining territory in Alberta on the south side of the Peace river in the foothills is the Pouce Coupe possible oil field. Upwards of three hundred thousand acres have already been leased, and this area may be doubled before many weeks.

Along the Athabaska river, North of Fort McMurray, for a distance of nearly one hundred miles, are exposed a bituminous sand formation, commonly known as "tar sands". The real problem connected with this deposit is one of extraction. No commercial process has yet been found which will separate the sand economically, but it is only a matter of time before this extensive deposit can be utilized.

In the Great Slave lake district, oil seepages have been found on the North shore at Windy Point and on the South shore of the lake at Pine Point. The geological formation is such as to lead us to believe that quite a good field may eventually develop when transportation difficulties have been solved.

The new regulations relative to petroleum in the Northwest territories are far from perfect. Probably the best clause is one which makes it necessary to obtain the consent of the Minister before a lease can be transferred, as this tends to prevent speculative trading in leases. On the other hand restrictions are so great, in that three quarters of all ground staked is reserved by the crown, that they will discourage and possibly prohibit outside capital. If capital is not brought into the country to carry on development it is not available in Canada, and development will not progress as it should.

An interesting discussion followed the reading of Professor Allan's paper. In answer to a question by G. N. Houston, M.E.I.C., Chairman of the Branch, Professor Allan stated that when the Athabaska River sands are heated the tar, runs leaving quartz sand, the formation being thus a sandstone with a bituminous binder. As regards excavating machines for the tar sands no successful machine has yet been found as the material is so sticky that it adheres to the dipper. In reply to a question as to the geological relation of natural gas and oil it was stated that the presence of natural gas is not in itself an indication of the presence of the heavier members of the petroleum series, though if "wet", that is, containing lighter members of the series, the gas is a good indication of the presence of oil

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On March 3rd, a largely attended general meeting was held to discuss compensation of engineers. At this meeting a report of the Committee on Compensation and Classification was submitted by Major P. J. Jennings, O.B.E., M.E.I.C., Chairman of the Committee.

At the request of the Chairman of the Branch the report and schedule of the Manitoba Committee was read, followed by the report of this Branch's Committee.

One of the important recommendations brought out in the report of the Branch's Committee was that recognition or approval of the pledge which the members of the Manitoba Branch are called upon to sign should be deferred until a definite policy of action has been decided upon, and in this connection the Committee urged that steps be taken with a view to expediting the report of the Policy Committee of the parent Institute.

The recommendations of the Committee included other clauses than the above, and were put to the meeting, clause by clause. Each clause afforded considerably discussion and it was apparent that the report was generally approved.

The Executive of the Branch has appointed a Publicity Committee to revise the report for publication, and to act as a permanent committee on remuneration and classification.

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On March 8th, Professor G. M. Williams, who, in addition to being an Associate Member of the E.I.C., and the American Society of Civil Engineers, is a member of the American Society for Testing Materials, and the

American Concrete Society, and was formerly connected with the United States Bureau of Standards, addressed a large and enthusiastic meeting, giving a paper entitled, "A Logical Scheme for Determining the Concrete Making Value of Available Aggregates, and its Practical Application to the Production of Concrete of Pre-determined Quality in the Field".

Saskatchewan Branch

D. A. R. McCannel, A.M.E.I.C., Secretary-Treasurer.

The January meeting of the Branch was held on January 13th in connection with the customary monthly dinner and was very well attended. The members noticed that the Paper and Library Committee had arranged a short entertaining programme at the conclusion of the dinner, immediately preceding the meeting. This arrangement will be kept up at all succeeding meetings.

The Branch report to the Annual Meeting of *The Institute* was read and with some slight alterations adopted. The members will find it printed in the report of the Annual Meeting of *The Institute* in *The Journal.*

H. G. McVean, A.M.E.I.C., was nominated to represent the Branch at the forthcoming Annual Meeting in Toronto and the Secretary advised that Messrs. D. A. R. McCannel, A.M.E.I.C., and A. N. Ball, A.M.E.I.C., would likely attend also. These three members were instructed to take a stand against the increase in *Institute* fees.

It gave the Branch great pleasure to support the suggestion of the Calgary Branch, that the general secretary make an annual trip to Western Canada, preferably at the beginning of March.

A Branch-Assessment was levied for 1921, as follows: $5.00 for members residing in Regina, $4.00 for members residing outside of Regina, while student members are exempt.

At the conclusion of the business meeting, Major A. P. Linton, A.M.E.I.C., read a paper on "Bridges", giving an extensive historical sketch of bridge-building and submitting valuable suggestions regarding the design of bridges.

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The February meeting of the Branch took the form of an At Home, held on February 10th in the spacious premises of Statt's Limited, Regina.

The Paper and Library Committee, under the Chairmanship of Colonel A. C. Garner, M.E.I.C., had done their utmost to make this function a success and every detail had been thoroughly contemplated.

Shortly after eight o'clock the Reception Committee, consisting of members of the Executive Committee and their wives, assembled on a decorated platform and received the members and guests of the Branch. The Regina members had invited all the outside members and their ladies and were hosts to them during the whole time of their sojourn in the City.

A number of outside members of the Branch availed themselves of an opportunity to meet their fellow members at a social evening and the following could be noticed: Mr. and Mrs. W. H. Greene (Moose Jaw), Mr. and Mrs. C. H. Davis (Moose Jaw), H. W. Crosbie (Yorkton), H. A. McLean (Moose Jaw) and J. R. C. Macredie (Moose Jaw).

The Branch invited also representatives of all other academic professions (Clinical Society, Assoc. of Architects, Assoc. of Land Surveyors, Law Society), as well as from the Rotary-, Kiwanis-, Canadian Club, etc.

A very good turnout contributed largely to the success of the evening, which began by dancing, interrupted frequently by solos (piano, violin, songs, recitations, etc.) rendered by Branch members and other local artists. At eleven o'clock supper was served and over one hundred sat down at the beautifully decorated tables, while the orchestra rendered a number of selections. After supper the programme was resumed and kept up until a late hour.

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The Branch has decided to hold the Western Professional Meeting for 1921 during the latter part of July in Saskatoon. All Western Branches have promised their most hearty support, both in attendance and paper-programme and just while writing this report a telegram was received from the general secretary advising that the Parent Council endorses the Professional Meeting.

Our Branch expects in the near future, especially from the Winnipeg and the two Alberta Branches, an outline of sessions, which they wish taken up. A session on "Concrete in Akali Soils" has already been decided on, at which the extremely interesting and important results of the experiments conducted by the Concrete Committee of the Branch (headquarters Saskatoon) will be presented by Professors C. J. Mackenzie, M.E.I.C., and G. M. Williams, A.M.E.I.C.

The Executive Committee of the Branch hopes that a large number of Branch members will attend and invites contributions to the paper-programme and suggestions in this connection.

Retires from Secretaryship

J. N. de Stein, M.E.I.C., who has, almost since the inception of the Saskatchewan Branch, originally "Regina," been the Branch's efficient and enthusiastic Secretary, has recently turned over the reins of office to D. A. R. McCannel, A.M.E.I.C.

Mr. de Stein has always been in the forefront of all movements calculated to benefit the engineering profession. As Secretary of the Branch and Associate Editor of *The Journal*, his name is known throughout Canada as one who has taken a leading part in the activities of *The Institute.* The second general professional meeting of *The Institute* held at Saskatoon, owed a great deal of its success to the untiring efforts of Mr. de Stein. It will be recalled that on that occasion his speech in response to the toast to the ladies was a gem of purest ray serene.

His excellent work for the profession will always be appreciated and in retiring from the Secretaryship he will be missed, not only by the Branch but by his associates on *The Journal* and by *The Institute* at large.

Mr. de Stein was born at Petrograd, Russia, on August 28th, 1880, and after receiving seven and a half years university training on the continent, occupied the position of assistant professor for five years. In 1905 he came to Canada, starting with the Grand Trunk Pacific on prairie construction and later in British Columbia. In 1908 he became resident engineer on maintenance in Manitoba. Two years ago Mr. de Stein became associated with the Parsons Engineering Company, with which company he now holds the position of manager. He is also a member of the firm, Western Drafting and Blueprinting Company.

J. N. de STEIN, M.E.I.C.

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The Fourth Annual Meeting of the Saskatchewan Branch of *The Engineering Institute of Canada* was held at the Kitchener Hotel, Regina, at 8 P.M. March 8th. The business session was preceded by a dinner at 6.30, after which a short musical programme was given, which was much appreciated by the members present. The Annual Meeting was so arranged as to follow the Annual Meeting of the Saskatchewan Land Surveyors Association, to which several of our members belong. By combining the dates, it was possible to secure a better attendance of the out of town members.

The business of the meeting consisted chiefly of the annual reports of our standing committees of the Branch, and of these reports special mention is due to the report of the committee on the "Investigation of Alkali Ground Water on Concrete". This committee, under the able chairmanship of Professor C. J. Mackenzie, M.E.I.C., of the Saskatchewan University, carried out considerable further investigation into this important question during the past year.

The test blocks of concrete, which were placed in various localities during 1919, were inspected during the past season and re-set in a different manner, in some cases, further to investigate other features of this question during the current year. A great deal of laboratory work was carried out and much valuable information was received. From the report of the committee, the following are a few of the deductions made as a result of their investigations to date.

First — The idea that concrete, if well made, is safe from alkali action can forever be dismissed.

Second — The poorer the quality of the concrete the greater the action of the alkali, while for ground water with strength up to 1% of alkali, a concrete can be made to withstand alkali action for a period of at least one year.

Third — The character of the ground water may vary greatly within a very short distance and often what may be taken to be similar conditions upon exposure are really widely different.

Fourth — Within a short radius examples were found where the concentration varied from one to 5.14%. This concentration was variable throughout the year, maximum variation being found as high as 300%. Generally the concentrations were lowest in the spring and increased with the hot weather until fall.

The financial statement submitted by the Auditors showed the Branch to be in the best condition since its inauguration with a cash balance of over $300.00. Following the reports of the standing committees, the Scrutineers' report on the elections for the ensuing year were received. The election results being as follows:—

Chairman — W. R. Warren, A.M.E.I.C., chief engineer Saskatchewan Telephones, Regina.
Vice-Chairman — J. R. C. Macredie, M.E.I.C., district engineer C.P.R., Moose Jaw.
Secretary-Treasurer — D. A. R. McCannel, A.M.E.I.C., city engineer, Regina.

Executive Committee — Two Years.

Prof. C. J. Mackenzie, M.E.I.C., University of Saskatchewan, Saskatoon.
W. H. Greene, A.M.E.I.C., city engineer, Moose Jaw.
J. W. Calder, A.M.E.I.C., city engineer, Swift Current.

Executive Committee — One Year.

H. McIvor Weir, M.E.I.C., asst. city engineer, Saskatoon.
C. W. Dill, M.E.I.C., provincial superintendent of highways, Regina.
A. J. McPherson, A.M.E.I.C., chairman, Sask. Water Supply Commission, Regina.

Nominating Committee.

L. A. Thornton, M.E.I.C., city commissioner, Regina (Convenor).
M. A. Sinclair, A.M.E.I.C., engineer's department, Moose Jaw.
Prof. A. R. Greig, M.E.I.C., University of Saskatchewan, Saskatoon.
M. B. Weekes, M.E.I.C., provincial director of surveys, Regina.
E. H. Phillips, A.M.E.I.C., Saskatoon.

A hearty vote of thanks was extended to the retiring Secretary-Treasurer, J. N. deStein, M.E.I.C., who had held this office since the Branch was organized.

Following the business of the evening, a very interesting and instructive paper on "Sanitary and Decorative

Tiles" was presented by M. L. Moyer, Affiliate of the Branch and in connection with the paper a large and varied exhibit of the Saskatchewan Clay Products was displayed, having been loaned for the occasion by the Saskatchewan Bureau of Industry.

Western Professional Meeting

The details are now under way for the Western Professional Meeting for the four Western Provinces, which is to be held in Saskatoon, Saskatchewan, this summer. It is hoped that further details concerning papers and the date of the meeting will be available in the near future and the co-operation of the Western Members is earnestly solicited to insure that this summer's meeting may be bigger and better than ever.

New Secretary

D. A. R. McCannel, A.M.E.I.C., who has been elected Secretary of the Saskatchewan Branch, was born at Burgoyne, Ont., in 1890, and was educated at Queen's University, graduating as Bachelor of Science and Civil Engineering in 1914. Mr. McCannel's experience has been principally on municipal work practically in connection with drainage, etc.; he has been connected with the city engineering department of the City of Regina since 1912, and is now city engineer.

Winnipeg Branch

Geo L. Guy, M.E.I.C., Secretary-Treasurer.

On the 2nd. February, 1921, at a meeting held in the Engineering Buildings, Manitoba University, J. G. Legrand, M.E.I.C., in the chair, a paper was read entitled "Publicity" by James Quail, M.E.I.C.

The object as stated was to interest the Branch in publicity, generally, defined as the state of being public, and to interest particularly in the processes of the development and the reaction of the public to the state.

The subject was shown to subdivide itself naturally under the headings of Directed and Undirected Publicity. Directed publicity was presented in detail under the headings of Advertising, Press Bureau Work and Propaganda. The matter of Undirected Publicity was touched upon.

Advertising was defined as being those obvious methods of publicity designed to sell service or commodities. The consideration of the historical development of advertising, the effect of advertising in speeding up world development, the place of advertising in to-day's merchandising activities was followed by a consideration of a particular advertising campaign. Attention was drawn to the defenses of the consumer that limited the effect of advertising. It was shown that successful advertising depended for its success on the degree to which it demonstrated a service as being fundamental to the commodity advertised.

Press Bureau Work was said to be a direct result of advertising; advertising having created sufficient public interest in the commodity the advertising mediums welcomed as news semi-editorial articles written with the commodity as the centre of interest.

Propaganda was defined as publicity with the object of developing a doctrine or belief. Propaganda to be successful must demonstrate that a real service or advantage results from the adoption of the belief. An example of a successful campaign of propaganda was given.

It was pointed out that mutual advantage results from all forms of publicity when the basis of the campaign is truth; that in the case of the producer the planning and development of the campaign crystalizes his plans and provides a continuous urge to service.

An active discussion of the methods that might be used to provide the engineering profession with publicity followed.

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On the 3rd. March at the regular meeting of the Branch held in the University Buildings, Winnipeg, W. M. Scott, M.E.I.C., in the Chair, a paper was read by E. V. Caton, M.E.I.C., entitled: "The Use of Electric Power for Domestic Heating".

In the preface the paper stated that the object of the paper was not to announce any new discoveries but to present in concrete form the information already available on the subject, together with such data as was available, and to discuss the matter from an economic point of view.

It was stated that the subject of electrical heating of dwelling houses was nothing new; it had been the subject of judicial investigation and that statements had been made by well known authorities on the matter in Canada. The subject was approached from the viewpoint of, not whether it was possible to heat houses electrically which were specially favorably situated in respect to the supply of power or for houses where the owner was willing to set aside all question of cost, but whether it was feasible to supply electrical power for heating on the same basis as power is now supplied for light and other domestic uses.

A large attendance was present and an energetic discussion took place.

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On 17th. March, at the regular meeting held in the University Buildings, W. M. Scott, M.E.I.C., in the chair, a paper was given by G. R. Pratt, A.M.E.I.C., entitled "House Heating in Western Canada".

Mr. Pratt discussed the various methods at present in use for heating houses, pointing out the advantages or otherwise of the different systems. He also considered the different classes of fuel available, including electric power. He pointed out the necessity for a much more careful study being made of the efficiency of fuel combustion for heating purposes and the large scope there was for improvement over present day practice. He described an arrangement of house furnace which he had designed and had operated successfully, consisting of dividing the fire box by a brick arch, and illustrated by a diagram the effect this arch had upon combustion of the furnace and how it was specially adapted for using Western coal. He also dealt with the question of electric heating, suggesting that this might be used during off peak periods as a supplement to coal heating.

A very live discussion took place, in which many of the members participated.

Among the business transacted at the meeting was the appointment of James Quail, A.M.E.I.C., as publicity representative for the Branch, with the idea of getting more publicity of the meetings and activities of the Branch in the local papers.

Professor Fetherstonhaugh of the University of Manitoba invited the members to be present at two lectures given by A. V. White, consulting engineer, the Commission of Conservation, on "Canada's Fuel Problem" and "Canada's Water Power Heritage". These lectures are to be given before the University of Manitoba on 21st. March and 22nd. March. An invitation was also given to the members to attend a dinner given by the Engineering Society of Manitoba University on 1st. April.

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Local News

The re-inforced concrete bridge being built across the Assiniboine River by the City of Winnipeg, W. P. Brereton, M.E.I.C., being engineer in charge, is progressing rapidly. All the footings have now been placed to rock and it is expected that the superstructure will be commenced immediately after the spring flood.

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The power was turned on the extension of the Manitoba Power Commission lines between Oakville and Carman on 18th. March. It is expected that the line will be completed to Morden in the near future. This line taps off the Portage la Prairie transmission line at Oakville and when completed will serve the following towns: Oakville, Elm Creek, Carman, Jordan, Morden and Rowland. The Commission have recently completed the installation of two plants at Minnedosa and Virden; both of these plants are operated by semi-diesel engines and are designed so that they can be made part of a general provincial distribution system.

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Work on the City of Winnipeg's Hydro-Electric extension is progressing favourably. Two of the 7000 H.P. water turbines have been delivered and it is expected that the complete extension will be finished for use in the coming fall. This will increase the present plant by 21,000 H.P., making a total available capacity of 69,000 H.P. The new transmission line is practically completed and it is hoped to get same in service early in June.

Border Cities Branch

J. E. Porter, A.M.E.I.C., Secretary-Treasurer.

The regular monthly meeting of the Border Cities Branch was held in the office of the Dept. of Public Works, Friday evening, March 11th.

Engineering legislation was discussed at some length with a view to getting in touch with the members of the Ontario Legislature in this district to support the Bill. H. B. R. Craig, M.E.I.C., and J. J. Newman, M.E.I.C., reported the work that had already been done and the results of interviews with several members of the Legislature which were very encouraging.

Points of policy were also touched upon. The Branch wished to place itself on record in censuring one of its members for acting in what was considered a very non-professional manner. Discussion ensued as to whether the member's name be made known. The Chairman ruled that it should — where upon a handsome clock was presented to Mr. and Mrs. J. E. Porter by W. J. Forbes-Mitchell, A.M.E.I.C., and J. J. Newman, M.E.I.C., on behalf of the Branch, the offence being that the Secretary had taken the marriage vows without, first having gained the sanction of the Border Cities Branch of *The Engineering Institute of Canada.*

Niagara Peninsula Branch

Rex. P. Johnson, A.M.E.I.C., Secretary-Treasurer.

G. R. Taylor, Branch News Editor

On February 24th. a dinner was held at the Welland House, St. Catharines. After dinner, E. L. Cousins, A.M.E.I.C., chief engineer of the Toronto Harbour Commission, gave a very interesting address, illustrated with views, on the work of the Harbour Commission. It is unnecessary to give here any details of the address, as it is covered by the paper published in the March number of *The Journal.* The Branch greatly appreciated Mr. Cousins' kindness in coming across to give this address.

The General Meeting of the Branch was held at the Thorold Engineers Club on March 10th. for the purpose of discussing and ratifying, or otherwise, the Bill which it is proposed to bring before the Ontario Legislature at the present session.

F. E. Sterns, A.M.E.I.C., Chairman of the Branch Legislation Committee, reported that a careful analysis had been made of the Bill, and that it was recommended that the Bill should be endorsed, with provision that the Bill should be made to apply to all qualified engineers. Certain changes in phraseology were also recommended.

R. R. Stevenson, of the Advisory Conference Committee, who had come over for the meeting, explained the present status of the Bill, and also amendments that were to be incorporated.

T. L. Crossley, A.M.E.I.C., of the Chemical Association, explained that the Bill had received the endorsation of the Provincial Chemists, and that they were organizing a Provincial Division, with the object of supporting the Bill.

After an interesting discussion, in which Mr. Stevenson further elucidated various points in the Bill, Mr. Sterns moved and Mr. Harcourt seconded the following resolution:

That the Branch adopt the report of the Branch Legislation Committee, with the exception of the clause which recommends the application of the Bill to all engineers, and with the addition of the following clause in the Bill:—

"This Bill shall not be construed to mean that only Chiefs of the Engineering Organization and Consulting Engineers shall be eligible for registration," — the motion carried unanimously.

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D. T. Black, A.M.E.I.C., city engineer of Niagara Falls, Ontario, has been appointed city engineer at Galt, and leaves to take up his new duties on the first of April.

Members of the Branch will be very sorry to loose Mr. Black, who has always taken an active part in Institute affairs in this district. Mr. Black is quite an old resident of the Peninsula, as he has been 8 years in Welland and 2 years in the Falls.

We understand that Mr. Black and other engineers in the district to which he is moving, contemplate endeavouring to form a Branch of *The Institute* in that district, and we are sure that all members wish him every success.

Toronto Branch

H. A. Goldman, A.M.E.I.C., Secretary-Treasurer.

Feb. 24th—New Methods of Proportioning Concrete Mixtures

At this meeting of the Branch R. B. Young, A.M.E.I.C., described the experimental basis of New Theories of Proportioning Concrete and T. V. McCarthy, A.M.E.I.C., explained the methods found satisfactory in field operations connected with same. There were a number of slides shown to illustrate both theory and practice.

Mr. Young said that the basis of the new theory was the idea of proportioning concrete so as to develop a certain desired minimum strength in a specified time. This he considered to be more logical than the specifying of a certain mixture because any results obtained by the use of a certain mix would depend on the variable conditions, consistency, materials used and methods of mixing and placing. As consistency was considered to be a more important feature than strength, the attempt had been made to proportion concrete not only for a given strength but for a given consistency.

Mr. McCarthy explained the methods used in applying these new theories on the construction of the Hydro-Electric Power Commission's Power Plant at Cameron's Falls on the Nipigon River where 35,000 cu. yds. of concrete had been placed.

Messrs. A. T. C. McMaster, M.E.I.C., Wm. Gore, M.E.I.C., C. R. Young, M.E.I.C., A. W. Connor, A.M.E.I.C., J. M. Oxley, A.M.E.I.C., A. H. S. Adams, G. A. McCarthy, M.E.I.C. and Prof. Peter Gillespie, M.E.I.C., took part in the discussion which followed.

March 3rd—Ice Formation and its Prevention

There was a joint meeting of the Toronto Branch E.I.C. and the Toronto Section A.I.E.E., at which John Murphy, M.E.I.C., of Ottawa, electrical engineer of the Dept. of Railways and Canals, gave a most interesting and thorough review of investigations into the methods for the prevention of the formation of ice in hydro-electric practice.

GEO. T. CLARK, A.M.E.I.C.

Chairman Reception Committee, Annual General Meeting, 1921

He gave a brief historical review of outstanding events which marked the progress of the electrical industry and also traced the various efforts to combat the ice troubles which all plants have. He expressed the opinion that it was possible to prevent ice from adhering to valves, gates, runners, etc., by the employment of a small amount of heat and even to prevent ice from forming in a stream. Results have shown that ice will not cling to metal if the metal is a fraction of a degree above freezing point.

There were a number of slides shown to illustrate the ice troubles with which plants have to contend. An interesting series of moving pictures of an experiment were shown to illustrate the formation of frazil and anchor ice. 2 gallon and 5 gallon bottles of water had been placed in a refrigerator and on removal showed no sign of ice in the bottles, but any cold iron rod or rope inserted in the bottles was the nucleus of an ice formation around same — the greater the agitation the larger was the amount of ice so formed.

March 10th—Legislation

The first part of the evening was devoted to the receiving of a report from Messrs. Willis Chipman, M.E.I.C., and F. R. Ewart, Chairman Toronto Section A.I.E.E., Members of the Advisory Conference Committee, on the question of Legislation. According to the report the Bill already presented to the Branch with a few amendments had been submitted to the Legislature. A plan of action in connection with this matter was decided on and members were asked to co-operate and to give this Bill their heartiest support.

T. D. MYLREA, A.M.E.I.C.

Chairman Structural Engineering Sectional Meeting, Annual General Meeting, 1921

T. M. Jones, A.M.E.I.C., showed a series of lantern slides illustrating the different types of centrifugal pumps. A. T. Clark then briefly dealt with a few points connected with the theory and design of centrifugal pumps.

R. W. DOWNIE, S.E.I.C.

President Engineering Society, University of Toronto

Peterborough Branch

R. L. Dobbin, M.E.I.C., Secretary-Treasurer.

In a recent address given by W. G. Gordon before Peterborough Branch, he emphasized that the electric locomotive has secured remarkable results in heavy mountain railroading. R. Beeuwkes, the electrical engineer of the Chicago, Milwaukee & St. Paul Railway Company, has recently stated — "In no respect have the results of the electrification failed to equal the expectations of the railway organization, and in most respects these expectations have been far exceeded. The extent of the electrification is such as to leave no doubt as to the practicability of indefinite expansion with an insurance of increased reliability and safety and a marked and determinable increase in capacity. Items of operating expense dependent on whether steam or electricity is used as a motor power, we have found by experience and estimates to be so reduced and the benefits indirectly obtained to be so great as to render justifiable, even with the increased investment charges, the serious consideration of indefinite extension of electrification, even for lighter grades."

A Commission of French engineers recently made a very thorough investigation of electrically operated railroads in the United States and their conclusions are summed up by the Secretary of the Commission: — "On account of the remarkable results obtained by the Chicago, Milwaukee and St. Paul Ry. with 3000 volts direct current, the writer does not hesitate to conclude formally in favour of the adoption of this system, and he believes it to be actually the only system suitable for the electrification of heavy traction lines."

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The regular meeting of the Branch, on Feb. 24th. was addressed by Alex. J. Grant, M.E.I.C., of St. Catharines, chief engineer of the Welland Ship Canal.

Mr. Grant described the location and construction of the canal and gave a short history of its predecessors. The paper was illustrated with many lantern slides, showing the methods of construction used in this great work.

The regular meeting on Mar. 10th. was addressed by Clayton D. Dean, A.M.E.I.C., of Toronto, who read a paper on "Oil Refining Practice". Moving pictures of the Imperial Oil Refinery at Sarnia were used to illustrate his remarks.

At this meeting a motion to amend the Branch By-laws, so as to allow Juniors to vote and hold office, except that of Chairman, was received and a letter ballot will be taken.

A Nominating Committee composed of the following was appointed to nominate the candidates for the coming Branch elections: Messrs. R. B. Rogers, M.E.I.C., R. H. Parsons, M.E.I.C., and C. E. Sisson, M.E.I.C.

Kingston Branch

W. P. Wilgar, M.E.I.C., Secretary-Treasurer.

During the present year the Kingston Branch has held bi-monthly meetings, for which programmes were arranged, and a number of special meetings, occasioned by the business of the Branch.

The attendance in all cases has been of a high average, and the interest evidenced by the Student and Junior members has given the Executive a valuable support.

In January, H. W. Nicholl, educational director of the Goodyear Tire Company, gave an illustrated lecture, tracing the rubber tire from tree to scrap. He treated his subject in a manner that was both entertaining and instructive.

On Saturday February 5th, Colonel H. C. Boyden of the Portland Cement Association, read a paper on "Recent Developments in Concrete". He outlined the salient points of recent research, and deduced therefrom, without a redundant phrase, modifications that should obtain in Concrete Specifications.

On the eighth of February, W. P. Dobson, M.E.I.C., research engineer of the Ontario Hydro-Electric Power Commission, demonstrated, in a very interesting paper, the design and operation of high tension transmission lines.

The subject, to those who knew of such things only through seeing the poles and wires, sounded a bit dangerous, but Mr. Dobson presented his theories in such logical sequence, that he impressed and delighted a gathering of all branches of the profession of engineering.

On the 15th of February, W. H. Winterrowd, A.M.E.I.C., gave an illustrated lecture on Snow Fighting.

He explained the development of the present mechanical plant, from its earliest days, commenting in humorous vein on the successes and failures of the various efforts of designers.

His slides of ploughs in operation, and his recital of the experiences of the operating crews raised enthusiastic applause.

On Tuesday March 15th, Professor L. V. King, Professor of Physics of McGill University, read a paper on "Fog Signalling".

His explanation of the investigations of sound travel and detection, as carried out at the Experimental Station at Father Point, made a highly technical subject a very popular lecture.

At a recent meeting of the Branch, provision was made for annual prizes for papers contributed by the Student and Junior members of the Kingston Branch.

In order to give the widest possible latitude in choice of subject, the only condition imposed was, that the paper should concern some branch of engineering as covered by the Calendar of the Faculty of Applied Science of Queen's University, or the course of the Royal Military College.

The Kingston Branch proposes to dine at the Frontenac Club on Tuesday, April the fifth, at 8 p.m.

The Entertainment Committee has on hand the preparation of a choice evening. Ginger ale and "Horses Necks" will flow like water. Only those who insist, will be allowed to speak and ambulances will be in attendance for visiting brothers.

The Kingston Branch now submits its apologies for its long silence and its cheerful assurance that the next one may be just as long.

Ottawa Branch

F. C. C. Lynch, A.E.I.C., Secretary-Treasurer.

That German-made mercantile airplanes are being made and laid down in Canada while British manufacturers are being forced to close their factories owing to lack of support was the amazing statement made at the annual popular lecture by *The Engineering Institute of Canada* in the lecture hall, Victoria Museum.

Commander C. P. Edwards, A.M.E.I.C., introduced the speaker and briefly outlined the subject. Col. E. W. Stedman then explained the development of flying from its very infancy.

Col. Stedman then drew the attention of the audience to an unique contrivance situated in the gallery. This was a launching-tube which set miniature airplanes loose in the auditorium so that all might see the phases of construction explained by the speaker as they fluttered to earth.

By means of these minatures Col. Stedman showed the different evolutions performed by machines equiped with "flat-surfaced" wings, with "cambered or slightly tilted" wings and with "variable" wings. Models were then launched showing the effect of small and large "vertical planes" and of small and large tail "horizontal fins", or planes.

A series of moving pictures was then shown after which the least scientific present could easily comprehend what was meant by such terms as "lateral and longitudinal stability", "angle of incidence," "centre of gravity," etc. Many an early pilot would doubtless have given a great deal to have had the science of aeronautics explained so simply and comprehensively. The pictures of the various machines used in the recent war were very interesting, being a valuable library of the development of flying through the five years of warfare. Some of the sea-planes shown gave the audience an altogether different conception of the enormous possibilities yet to be developed.

It was during the latter part of his speech that Col. Stedman made the statement that Germany was making mercantile machines, which were available for purchase in Canada. He showed several pictures of these remarkable machines. He then went on to point out the value of an amphibious machine which would fly from either water or land. Canada was specially adapted for such a machine.

"There is very little experimental work along these lines being carried out in England since the war while in Germany they are spending money on research work and are, moreover, producing the goods," said the colonel.

"It is true a certain amount of money is being spent here but what we want is an air-craft industry. We must have a commercial purpose first before we can have such an industry and in the north we have that purpose," he continued. To-day foreign firms were carrying passengers across the English Channel into England at one half the fare English firms could afford to charge. One of the most interesting moving pictures was that of the efforts of Squadron Commander Rutland and Flight Lieut. Jackson, R.N.A.S. to land fast air-planes on the deck of a moving battleship. In all save one of the experiments shown the pilots were successful. In the exception Commander Rutland went overboard but was saved.

Major General MacBrien, chief of staff, moved a vote of thanks to the speaker. "We must see that our representatives in Parliament have 'longitudinal and lateral stability' and do not leave us in the lurch in the matter of air-defence," said the general. "Aeronautics are invaluable in the fields of exploration, development and defence. If we have a country here worth developing it is also worth defending. We had 10,000 Canadian pilots at the end of the war and had it continued a short time longer would have had a force of our own," he concluded.

Col. O. M. Biggar seconded the vote of thanks.

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Col. Stedman was first interested in air work in 1912, when he was an assistant engineer with the Sturtevant Engineering Co., engaged upon the design of fans, etc. During 1913 the experimental work in aeronautics began to be extended and Mr. Stedman was appointed as a technical assistant in aeronautics at the National Physical Laboratory. At the outbreak of the war, Mr. Stedman joined the Royal Naval Air Service as a Technical Officer and served in that service and the Royal Air Force until March 1919; during this period he had command of a large Aircraft Repair Depot in France, and also held technical appointments in the Air Ministry.

From March 1919 until last summer Mr. Stedman was engaged by Messrs. Handley Page Ltd., as chief of their technical staff, and in this capacity had a good deal to do with the development of the new Handley Page Wing.

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The monthly meeting of the Ottawa Branch of *The Engineering Institute of Canada*, and the luncheon, which about 100 attended, was held in the ladies' cafe at the Chateau Laurier, on March 3rd. Lieut.-Commander C. P. Edwards, A.M.E.I.C., was Chairman.

Lieut.-Com. C. P. Edwards introduced the Minister of Labour and welcomed him on behalf of *The Institute*.

While not desirous of reverting too much to war days, the speaker said he could not help recalling what the engineers had done in the late war.

The necessity for a realization of the duties of citizenship, which the engineers had, was impressed as a national necessity. The engineer was the point of contact between the workman on one hand and the employer or investor on the other hand, great services to society as a whole could be rendered by the engineers, in this special capacity.

Before workmen organized for their mutual benefit, there was a tendency to forget to ask whether the workmen engaged on a structure were contented citizens, and the profit element overshadowed everything. But labour organized and there were many instances in Canada today of employers and employed, existing side by side in amity, content and fair dealing.

There were places in the world where capital oppressed labour, and other places where a labour dictatorship had been established, something born of former oppression. "There must," he stated, "be some half way ground, where each side can receive a fair share, and society get the general benefit thereof."

Today employers unite to protect their interest and the workman does the same. Today each recognizes that the other has rights. Today, the question is how by organized effort the best result for all may be obtained.

Hon. Mr. Robertson said that from what he had seen in the last two or three years he believed Canada was on the right track to solution of her industrial problems. The keystone of progress in this respect was confidence in each other, which led to co-operation and the achievement of big results.

The minister related how in 1918 men of contrary opinion were brought together on industrial survey boards, and learned to understand and respect each other, after a period of mutual suspicion. It was a great thing to establish points of contact, to get that understanding of each other that led to confidence and co-operation.

Industrial efficiency engineers were recently sent to Ottawa by their firms and a profitable gathering was held. Some thirteen large employers in Canada were experimenting with a plan for the betterment of industrial conditions, and were trying to work out a plan which would be adopted by consent of both employers and employed. These men represented close to 40,000 men in the plants in question, and when these men are brought into contact with employers in industrial councils, things that seemed difficulties frequently disappear and vanish.

Industrial councils should be advocated by the joint effort of both employers and employed. There were still some objections by employers to their men being organized, but even these men were finding that the advantages of dealing with their men as an organization far outweigh any disadvantages that might be attached.

"Industrial conditions in Canada," said the speaker, "are as good today as in any country in the world. But we must go forward or back. The future success of the country depends on the promotion of that spirit of confidence and co-operation." It was this duty to which the Dominion department of labor was devoting itself. To the extent that this can be done, is the measure in which our efforts succeed.

Lieut.-Com. Edwards commented that Hon. Mr. Robertson was in the position of a man who enjoys at the same time the confidence of labour and the respect of capital.

J. M. R. Fairbairn, M.E.I.C., President of *The Institute,* was present at an Executive meeting during his recent visit at Ottawa. Mr. Fairbairn took part in the general discussion of several matters affecting the Branch. H. B. R. Craig, M.E.I.C., Councillor, was also present as a guest of the Committee.

Montreal Branch

J. L. Busfield, A.M.E.I.C., Secretary-Treasurer.

On February 24th, Major J. J. Humphreys, engineer of gas production of the Montreal Light, Heat & Power Consolidated, gave an "illuminating" address on "Modern Gas Production". A city the size of Montreal, he stated, required a quarter of a million tons of coal annually to furnish the gas used by its citizens. This meant also the carrying on of a considerable business in by-products, which were utilized in the oiling of roads, manufacture of tar paper, fertilizers, and so forth. He pointed out that a century ago the same group of Scots who were developing the steam engine and steam locomotive, namely, Watt, Stephenson and Murdoch, were also developing the manufacture of gas for town use. On the American Continent the use of gas became general in the decade from 1845 to 1855, although there were isolated installations some years earlier. The first of these was in 1809 at Newport, R.I., where a lighthouse engineer named Melville installed a plant in the cellar of a building, which after a chequered career blew up. In the early days the outlook for the gas business was so speculative that contractors for plant were usually compelled to take a large part of their payment in shares of the gas companies. In many cases this luckily proved for them a good speculation. In the eighties the competition of kerosene was the bugaboo of the gas man; in the nineties the development of electric lighting caused him grave concern; today, however, all three industries are flourishing in their own fields.

A description illustrated by diagrams and lantern slides was given of the main features of modern gas plants, the two main types being the coal gas and the carburetted water gas. It was brought out that practically everything in the way of engineering material required for gas works could now be made in Canada, with the exception of silica refractories. The meeting was presided over by F. A. Combe, M.E.I.C., and the address was followed by a discussion in which Drs. Stansfield and King and Messrs. Hunter, Macphail, Burnett and Farmer took an active part.

On the evening of Thursday, March 3rd, papers were read by J. H. Valiquette, A.M.E.I.C., and F. V. Dowd, A.M.E.I.C., on the Sewerage System of the City of Montreal and on Sewage Pumps, respectively. It is hoped that both of these papers will be published in *The Journal* in due course.

During the discussion on this paper some interesting recollections were presented by Past President Sir John Kennedy. In the early fifties during his association with the Harbour Board, he recalled, there was a very imperfect system of drainage in Montreal, the main drainage was of the open variety and was found in the deep gullies which ran in the form of an enormous "S" from McGill College grounds to Burnside Place, thence easterly along the valley now occupied roughly by Ontario Street as far as Fullum Street then turning towards the river on Craig and running westward along the creek and down through Chaboillez Square where it joined a creek known as the River St. Pierre from the East and thence on to St. Anns Market and into the river near the Customs House. In those days, the waterworks intake was a little East of Bonsecours Market and when the terrible outbreak of cholera occurred in Montreal attention was drawn to a canvass as to the cause of the disease, which followed the old ideas as to food, bad fruit, and other things, and finally found its solution in the water poisoned by contact with the sewage of the city. It was this outbreak that directed attention to the necessity for modern underground sewers and which spurred the city fathers of those days to adopt plans for improvement leading ultimately to the system as it existed today.

At this meeting congratulations were tendered to Dr. A. Stansfield, M.E.I.C., and R. deL. French, M.E.I.C., on having recently been awarded the Plummer and Gzowski Medals respectively.

On March 10th, a paper by Messrs. G. C. Read and S. Cunha on "13,000-volt Surge Protectors" was read by the former and followed by an interesting discussion.

On March 17th, Chester B. Hamilton, Jr.,M.E.I.C., of Toronto, read a paper on "Toothed Gears" in which he treated the subject very exhaustively. At this meeting a hearty welcome was extended to Walter J. Francis, M.E.I.C., on his return after a number of months absence. Mr. Surveyer, who presided at the commencement of the meeting, made a very pleasing speech of welcome and congratulation and marked the occasion by requesting Mr. Francis to occupy the Chair. Mr. Francis thereupon thanked the Branch in a few well chosen words.

Mr. Hamilton treated the subject of toothed gears from various points of view: material, relation of axes, method of tooth production, form of the tooth, class of service. Dealing with the material classification some interesting information was given relative to the early forms of wood gears and figures were quoted for the best composition for bronze and steel gears. Mr. Hamilton took up in some detail the subject of tooth design and methods of gear production, the theory of the various developments in tooth design being very clearly set forth. Following the reading of the paper a very interesting discussion followed, during which the valuable work accomplished by the American Gear Manufacturers Association in working for gear standards was made very clear by Mr. Hamilton.

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At the fourth annual meeting of the Aerial League of the British Empire, the following *Institute* Members were elected to the executive:—Patron, His Excellency the Duke of Devonshire, Hon., M.E.I.C., Honorary President; Sir Herbert S. Holt, M.E.I.C., Honorary Vice-President; Dr. J. Bonsall Porter, M.E.I.C., Vice-President; Professor C. M. McKergow, A.M.E.I.C., and L. B. Rochester, S.E.I.C., members of the executive.

St. John Branch

Harry F. Bennett, A.M.E.I.C., Secretary-Treasurer.

A regular meeting of the St. John Branch was held in the Custom House on March 10th. 1921. The special feature of the meeting was a paper on "Street Paving in the City of St. John" by G. N. Hatfield, A.M.E.I.C., road engineer of the City of St. John.

Mr. Hatfield pointed out that the grades on the streets of St. John varied from one-half per cent to fifteen per cent and the majority of our streets have grades of from six to seven per cent. These hilly conditions limited the choice of pavements that might be employed, for a material had to be selected which would provide sufficient foothold for horses on the hills.

It had been found that granite block and asphalt were the best types of paving for use in St. John. Granite obtained from the "Spoon Island Granite Quarries" situated about 32 miles from St. John and having both rail and water connection with the city, produced a granite which was second to none for use as paving blocks. When these were placed on a concrete sub-base and a bed of sand with cement grout filler practically to the surface, continuous traffic for many years has had no apparent effect on the pavement other than a gradual smoothening of the surface.

Asphalt pavements laid on both cement concrete and asphaltic concrete sub-bases had been used to a great extent on both business and residential streets. This pavement gave a smooth traffic surface, produced less noise under traffic, and could be easily repaired. Its constituent parts, outside of asphalt and cement binders, were available in the vicinity of the city.

In connection with the paving of streets along the line of the street railway, Mr. Hatfield showed by plans and sketches the various types of foundations under the ties and the types of paving between and alongside the rails. He spoke of recent work which had a six inch concrete continuous foundation under the ties and up to the underside of the rails. In this case the ties were spaced four feet centre to centre and two tie rods to each rail. As this work was carried out on a street having considerable traffic the result will be watched with interest.

A great many problems confront the paving engineer in St. John, especially as to new grades for streets and the opposition of the abuttors to changes in the elevation of the sidewalks. Various expedients had been used to remove this trouble, such as the shifting of the crown of the street from the centre line towards one side or the other, and the raising of one curb above the normal height or its reduction below that height. Street intersections had also produced their problems but they had been overcome.

Mr. Hatfield went into the history of street work in St. John and stated that less than 30% of our streets were paved and that great strides must be made along these lines to eliminate the bad condition of through traffic, as well as strictly residential, streets. The question of whether business or residential streets should be paved first was one which caused considerable discussion. Mr. Hatfield felt that those streets which effected the economic situation should be constructed without delay.

The thanks of the meeting for the very interesting paper was extended to Mr. Hatfield by G. G. Murdoch, M.E.I.C., Chairman of the Branch.

Moncton Branch

M. J. Murphy, A.M.E.I.C., Secretary-Treasurer

Members of Moncton Branch held a very enjoyable supper on Monday evening, February 21st, in the Palm Room of the Brunswick Hotel, Ivan Rand, B.A., L.L.D., of the legal firm of Robinson and Rand being the speaker of the evening. His very instructive subject "Some Aspects of the Relation of Law to the Engineering Profession" was listened to with great interest. J. D. McBeath, M.E.I.C., Vice-Chairman of Moncton Branch, presided, and in introducing Mr. Rand stated he was well qualified to speak to the members on his chosen subject as he had studied engineering at Mount Allison University before taking up the study of law. Mr. Rand devoted considerable attention to the question of Contracts and referred to the engineer as an expert witness.

A vote of thanks was tendered Mr. Rand on motion of F. B. Tapley, M.E.I.C., maintenance engineer, Canadian Government Railways, and seconded by S. B. Wass, A.M.E.I.C., construction engineer, Canadian Government Railways.

The regular monthly meeting was held in the City Hall, Thursday evening, March 3rd, when nominations of officers for the ensuing year were made and resulted as follows:—

Chairman, J. D. McBeath, M.E.I.C.
Vice-Chairman, S. B. Wass, A.M.E.I.C.,
F. B. Tapley, M.E.I.C.
Secretary-Treasurer, M. J. Murphy, A.M.E.I.C.

Executive Committee of six Members:—

A. F. Stewart, M.E.I.C.
R. G. Gage, M.E.I.C.
F. B. Fripp, A.M.E.I.C.
R. O. Stewart, A.M.E.I.C.
K. S. Pickard, A.M.E.I.C.
F. O. Condon, A.M.E.I.C.
F. Williams, A.M.E.I.C.
H. Jardine, M.E.I.C.
R. McManus, A.M.E.I.C.
A. E. Oulton, Jr.M.E.I.C.
H. J. Crudge, A.M.E.I.C.
E. R. Evans, A.M.E.I.C.

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S. B. Wass, A.M.E.I.C., and Member of the Executive Committee of the Moncton Branch has been appointed inspecting engineer for the Highways Branch of Department of Railways and Canals for Province of Nova Scotia and Prince Edward Island. This position was made vacant by the appointment of W. A. Hendry, A.M.E.I.C., as chief engineer of Highway Board for Nova Scotia. Mr. Wass will still retain his position as construction engineer with Canadian National Railways at Moncton.

Halifax Branch

E. R. Faulkner, M.E.I.C., Secretary-Treasurer.

The regular monthly meeting of the Halifax Branch for January was held in the Nova Scotia Technical College, Friday evening the 28th. The speaker of the evening was John Murphy, M.E.I.C., of Ottawa who spoke on Hydro-Electric ice troubles and their prevention. Hydro-Electric power is a matter of intense local interest today, due largely to the fact that the Nova Scotia Power Commission, under the guiding hand of K. H. Smith, M.E.I.C., is just completing a plant at St. Margaret's Bay which is expected to supply the city of Halifax with electric light and power. For this reason the meeting was thrown open to the public and the attendance was large. F. A. Bowman, M.E.I.C., local Councillor, occupied the chair.

Mr. Murphy's address was illustrated by lantern slides and moving pictures. There is no doubt that many of the facts brought out were a revelation to the majority of the audience. The moving pictures showed ice in the process of formation and proved that before ice could form, some substance at a temperature slightly below freezing was necessary as a nucleus. In Hydro-Electric plants this substance is found in the metal of the trash racks and the turbines. As prevention is better than cure, the problem was, not to remove the ice after it has formed but to prevent the ice from forming. The slides showed how this could be accomplished and with a minimum amount of heat. Plants that had followed Mr. Murphy's suggestions were now able to keep running during the coldest weather. Owing to the lateness of the hour when the discussion ended, the usual business meeting was postponed.

The February meeting of the Branch was held at the Green Lantern, Wednesday the 23rd at 6.00 p.m. At the conclusion of the dinner Mr. Dodwell introduced the speaker of the evening, J. F. Ryan, Eastern representative of the Sherwin-Williams Co.

Mr. Ryan's subject was:—"Paints and their Uses". He first described the preparation of the essential ingredients of white paint; linseed oil, white lead, zinc oxide and turpentine. He was pleased to note that linseed oil produced from Canadian grown flax is admitted as being the best in the world. The various colours are obtained by mixing pigments with white paint and the speaker then described the methods of making pigments. The kind of paint to be used depended on the use to which it was to be put. A different kind of paint was required for wood than for metal, a different kind for interior use than for external use. The selection of a proper paint required the utmost care and attention and could be found only after the most careful experiments.

The discussion was carried on during the progress of the paper, the speaker answering questions or elaborating points as they were brought up. The interest in the question was evidenced by the fact that the majority of those present took part in the discussion. At the close of the paper, the Chairman tendered the thanks of the Branch to Mr. Ryan.

Professional Institute of Civil Servants

About a year ago, and largely on the initiative of the engineers, the Professional Institute of Civil Servants was formed, to permit the professional men of the Dominion Civil Service an opportunity to articulate as distinct from the general organizations of the Service. The objective of this new body is primarily to better the condition of the professional men in the employ of the Dominion Government and in no way to advance the technique of any particular professional group. There can therefore be no possible conflict with the existing professional bodies.

The Professional Institute has already justified its existence, and is accomplishing quietly but effectively much for the professional man in the Service. Indications from both Governmental and Civil Service Commission circles prove the timely appropriateness of this new body.

The Institute received a staggering blow when its first provisional President, Dr. Gordon Hewitt, one of the leading scientists in the Service, passed away suddenly on February 29th, 1920 following an attach of pneumonia. His successor, Dr. M. Y. Williams, consulting geologist of the Geological Survey, has piloted the Institute through the difficult channels of its first year.

The Executive Committee of the Institute on January 10th, 1921, was reluctantly compelled to accept the resignation of Dr. Williams, made necessary by his acceptance of an important post with the University of British Columbia, the duties of which he must assume immediately. K. M. Cameron, M.E.I.C., is now the Acting President.

Specifications for Asphalt Pavements

Asphalt Association Announces List of Printed Specifications for Distribution

The Asphalt Association, 95-97 King St. E., Toronto, Ontario has ready for circulation in printed form a number of typical specifications prepared by its Technical Committee, composed of highway engineers and specialists. In the preparation of these specifications, special attention has been paid to form and arrangement with the idea of making them definite, concise and free from ambiguities. The printed specifications are on single fold sheets of size adopted by the U.S. Bureau of Public Roads, most of the state highway commissions and many municipalities. Those now ready are as follows:

A-1, Asphalt Macadam Surface Course; A-2 Asphaltic Concrete Surface Course (coarse graded aggregate type); A-3, Asphaltic Concrete Surface Course (fine graded aggregate type); A-4, Sheet Asphalt Binder and Surface Courses; B-7 Asphaltic Base (asphalt macadam type)

A limited number of the following specifications in moneographed form may also be obtained upon request.

A-5 Asphaltic Concrete Binder and Surface Courses; B-1, Gravel Base; B-2 Macadam Base; B-3, Reconstruction of Old Macadam to Serve as Base Course; B-4, Telford Base; B-5, Portland Cement Concrete Base; B-6 Trueing up Old Pavements to Serve as Base Course; C-1, Preparation of Subgrade; C-2, Sub-base; C-3, Shoulders, Headers, Curbs and Gutters.

Specifications for asphaltic base (asphaltic concrete type) will be available for distribution in the near future.

During the preparation of these specifications, the Committee had before it the specifications of every state highway department in the United States, as well as those of a large number of the principal counties and cities, and of the U. S. Bureau of Public Roads. The opinions of many prominent highway engineers were obtained and digested. The committee, with Prevost Hubbard, formerly Chief of the Division of Tests and Research of the U. S. Bureau of Public Roads, as Chairman, was composed of engineers having long practical experience upon highway and pavement construction and design. In order to make them applicable to varying conditions throughout the U.S.A. and Canada each printed specifications is accompanied by a notice to engineers which will assist the engineer in modifying it, necessary to meet his particular requirements.

Institute Committees for 1921

FINANCE

R. A. ROSS, Chairman
H. H. VAUGHAM
SIR ALEXANDER BERTRAM
LESSLIE R. THOMSON
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Preliminary Notice

of Applications for Admission and for Transfer

21st March, 1921

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in April, 1921.

FRASER S. KEITH, Secretary.

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*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognised by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option Railway, Municipal, Hydraulic, Mechanical, Mining, or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits scientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

ALBERTSON—DAN JOHN, of Kalamazoo, Mich., U.S.A., 55 years old; Educ., Ap'tice to his Father (Engineer & Surveyor); In private practice as architect, surveyor and engineer since 1890, specializing in paper and allied industries. Work covers all matters in connection with large industrial plants; arch'l. work, civil engr'g. and surveying. Head Office, Kalamazoo, but has maintained offices in Canada at different times. Was consltg. engr. for Water Power Commission, State of Michigan. Member of Amer. Soc. of Civil Engrs., Amer. Soc. Mech. Engrs. and Amer. Assn. of Engrs.

References: F. F. Longley, A. G. MacIntyre, A. Milne, A. S. Cook, C. B. Thorne.

BIGRAS—JOSEPH ARTHUR, of Montreal, Que. Born at Cote des Neiges, Que., March 30th, 1895; Educ., 3 years Polytechnique, Laval, 1914-18; 1913, working for J. P. B. Casgrain; 3½ years, instr'man for F. C. Laberge. At present on engr'g work for J. Duchastel, City Hall of Outremont.

References. J. Duchastel, F. C. Laberge, J. P B Casgrain, J. A N Vermette.

BERRY—ROBERT CRAPPER, of Ottawa, Ont. Born at Bury, Lancashire, England, Nov. 1st, 1892; Educ., B.Sc., McGill Univ 1913; 1910 (5 mos.), rodman, location party, G. T. R. Sask.; 1911 (5 mos.), topog'r., C. P. R.; 1912 (5 mos.), instr'man, Mtce of way, C. P. R.; 1913-14, instr'man on C. P. R. Terminals, Montreal; 1914 (Feb.-Nov.), asst. engr., C. P. R Quebec Freight Shed, Constro; 1914-15, local supt., C. P. R. revision of ventilation plant, C. P. R. Bldg., Toronto; 1915 (Mar -July), local supt., C. P. R., steel fire door constrn., Chateau Frontenac, Quebec; 1915 to date, examiner in responsible charge of the scientific & geometrical instrument division of the Canadian Patent Office, Ottawa. This divn also includes all inventions covering glass working machinery, centrifugal apparatus, firearms, and ordnance.

References: K. M. Cameron, G. G. Gale, O. S. Finnie, L. G. Denis, J. B. McRae.

BODWELL—HAROLD A., of Toronto, Ont. Born at Mount Elgin, Ont., May 1st, 1878; Educ., Elec. engr'g., I.C.S.; 1901, making and assembling elect'l mach.; 1902-03, dfting for Sawer & Massey Co., Hamilton; 1904-05, install'n of power plant equipment & operation of plant; 1906-07, dfting for Electric Development Co., Niagara Falls, Ont.; 1907 (Jan.-Sept.), designing dftsman, Tenn. Coal, Iron & Railroad Co., Ensley, Ala.; 1907-08, designing dftsman, National Tube Co., Torain, Ohio; 1909 (Mar.-Oct.), dftsman, Toronto Power Co., Niagara Falls, Ont.; 1909-11, designing dftsman, hydraulic dept., Ontario Power Co., Niagara Falls, Ont.; 1911-12, sub-station layouts & design of steel towers, Toronto, Hydro Electric System; 1912 (July-Oct.), design of printing presses, Huffman Printing Press Co.; 1912-14, dfting, Toronto Power Co.; 1914-17, struct'l engr. in charge of all bldg. design for Toronto Hydro Electric System; 1917-20, struct'l & sales engr. for Reid & Brown Struct'l Steel & Iron Works Ltd.; March 1920 to date, struct'l engr. in charge of all bldg. design & supervision of all bldg. constrn. for the Toronto Hydro Electric System.

References: P. E. Hart, F. G. Clark, A. R. Holmes, M. V. Sauer, W. P. Dobson, E. B. Merrill.

BOURASSA—ISIDORE, of Ford City, Ont. Born at Sudbury, Ont., March 17th, 1897; Educ., Walkerville Tech. Class, struct'l drawing; 1913 (June-Sept.), with C. P. R.; 1914 (June-Sept.), rodman, C. N. R.; 1916-17, rodman on mine constrn., International Nickel Co.; 1917-20, rodman & instr'man, British American Nickel Corp.; on mine & smelter constrn.; May 1920 to Feb. 1921, instr'man for Owen McKay.

References: C. R. McColl, J. J. Newman, W. J. Fletcher, A. J. Riddell, J. E. Porter.

BRINER—EMIL AMANDUS, of New Jersey, U.S.A. Born at New York City, Nov. 17th, 1876; Educ., M. E. Cornell Univ., 1901; Member, Amer. Soc. Mech. Engrs., 1916; 2 years (prev. to Univ.), sales work with Johnson & Faulkner, N.Y.; 1 year, New York Shipbldg. Co., Camden, N.J.; 3 years, engine & boiler design, Neafie & Levy Ship & Engine Bldg. Co., Philadelphia; 9 years, eastern representative, New York Blower Co., in charge of eastern office contract work doing own engr'g work; 2 years in charge of heating, ventilating & drying dept. (especially paper drying) for N.Y. office of Green Fuel Economizer Co.; 2 years, paper specialist, in charge of air conditioning & drying paper for Carrier Engr'g. Corpn., New York City; At present private engineering practice, but considerable time is devoted to original work in field of invention, paper drying, waste heat recovery & other new and comparatively new work.

References: J. T. Farmer, I. J. Tait, C. B. Thorne, J. L. Busfield, G. M. Wynn, A. Pringle, H. S. Ferguson.

BUSH—CLAYTON ELGIN, of Toronto, Ont. Born at Toronto, Aug. 14th, 1885; Educ., B.A.Sc. Univ. of Toronto, 1907; D.L.S., O.L.S., A.L.S.; 1905 (summer), dftsman. C.N.R. office, Winnipeg; 1909, Ontario Govt. surveys, reporting on soil, timber, & water power; 1910-14, private practice, civil engr. & surveyor, Calgary, Alta.; 1914-19, overseas; 1919 to date, with Dept. of Public Highways, Ontario; At Present res. engr., prov. highway, Brampton-Chatsworth, 85 miles.

References: P. Gillespie, W. A. McLean, G. Hogarth, H. W. D. Armstrong, E. G. Hewson, H. T. Routly, C. H. Mitchell.

CAMERON—DONALD ROY, of Kamloops, B.C. Born at London, Ont., Jan. 14th, 1888; Educ., B.Sc.F., Univ. of Toronto 1911, B.A. McGill Univ., 1909; Forest surveys-Man. 1909, B.C. 1909, Hudson Bay Route 1910; 1911, Lesser Slave Lake, forest reconnaissance; 1912 to date in charge Dominion forest administration, railway belt of B.C. Constrn. of improvements necessary to efficient fire protection & administration of national forests in B.C., including roads, trails, telephone lines, buildings, docks, etc.; At present District Forest Inspector, Dom. Forestry Branch, Dept. of the Interior, Canada, in charge railway belt of B.C.

References: A. G. L. McNaughton, W. E. Blue, O. G. Gallaher, A. S. Fraser, C. G. Cline.

CANTWELL—HERBERT H., of Espanola, Ont. Born at Oxford, Maryland, Oct. 15th, 1886; Educ., B.E. Union Univ., 1907; 1907-15, rodman, asst. engr., & asst. supervisor of track, New York Central & Hudson River R.R.; 1915 to date, paper mill work as follows: res. engr. on hydro-electric ddvelopment, J. P. Brownell, consltg. engr, res. engr. on paper mill constrn., T. L. Tomlins, consltg. engr.; At present res. engr for Spanish River Pulp & Paper Mills Ltd.

References: K. G. Ross, G. H. Kohl, H. C. Baker, C. H. Mitchell, C. B. Hamilton, Jr.

CARLIN—JOHN WILLIAM, of Sydney, N.S. Born at Sydney, May 13th, 1884; Educ., Sydney Academy, Reg'd. Prof. Engr. of N.S.; 1901-05. land surveying; 1905, charge of layout and grading of about 14 miles of streets, Broughton; 1906, transitman on location, T.C. Ry.; 1907-08, bridge engr., charge of layout & constrn. on same rly.; 1909, asst. chief of party rly. location; 1910-12, plant constrn., Dominion Iron & Steel Co ; 1912 to date, with City of Sydney, and at present asst. city engr.

References: N. K. Hay, D. H. McDougall, D. F. Maxwell, J. R. Morrison, D. Morrison, B. H. Kinghorn.

CARMICHAEL—JOSEPH E., of Windsor, Ont. Born at Smiths Falls, Ont., Sept. 23rd, 1892; 1910-11, rodman & dftsman on mtce., C.P.R.; 1911-13, in charge of party on mtce., C.P.R.; 1913-15, with Owen McKay, O.L.S., D.L.S., C.E., in charge of party on munic. drainage, railroad engr'g., etc.; 1915-19, overseas; 1919-20, with Owen McKay, in charge of field work; 1920 to date, chief asst. to H. W. Patterson (Successor to Owen McKay).

References: W. J. Forbes-Mitchell, J. E. Porter, C. R. McColl, M. E. Brian W. J. Fletcher.

CARSON—GEORGE HERBERT, Jr., of Montreal, Que. Born at Danville. Que., Jan. 19th, 1896: Educ., A. A. Graduate, Danville Academy, 1912; 1913-14 (4 mos.), rodman, Laurentide Co.; 1914-17, dfting & field work, Laurentide Co.; 1917-19, overseas, Bty. Commander's asst. & observer, 11th Can. Seige Bty.; 1919-20, mech. & struct'l dftsman on plant layout & design for Laurentide Co.; Oct. 1920 to date, field engr., Three Rivers Pulp & Paper Co. Ltd

References: H O. Keay, G. R. Murdoch, J. J. O'Sullivan, E. A Ryan, E. Peden H. E. Bates.

CHIPMAN—HAROLD CASSELS, of Glace Bay, N.S. Born at Kentville, N.S., Dec. 4th, 1885; Educ, struct'l engr's course & ap'ticeship, estimates & design, Dominion Coal Co., Glace Bay, N.S., 1907-13; 1913-16, estimate, design and 2 years asst. foreman, munition plant, Eastern Steel Co., New Glasgow; 1917-19, estimate, design & charge of contract work, Roberts & Schaefer Co., Chicago; 1919-20, estimate & design, Dominion Coal Co., Glace Bay; Oct. 1920 to date, asst. chief dftsman, Dominion Coal Co., Glace Bay.

References: C. M. Odell, D. Morrison.

COMO—HENRY EMMERSON, of Sydney, N.S. Born at Minudie, N.S., Oct. 3rd, 1874; Educ., I.C.S. Civil Engr'g., 1902; 1899 to date (with exception of 1907-10 when res. engr. on rly. constrn. T.C. Ry.), with Dominion Iron & Steel Co. as follows:—1899-1902, rodman, 1902-04, transitman on steel works constrn. 1904-07, constrn. engr., mills. rlys., water & sewer systems, etc., 1910 to date, res. engr. on constrn., mtce & surveys. Work included supervision of misc. steel plants constrn. & mtce.

References: D. H. McDougall, C. M. Odell, G. D. Macdougall, H. Longley, D. F. MacIsaac.

COURCHENE—CHARLES EDWARD, of Quebec, Que. Born at Quebec, April 5th, 1891; Educ., Grad. Quebec Univ., 1913, Q.L.S. 1914; 1913-14, dftsman on T.C. Ry. constr.; 1914-16, office in Quebec; 1916-20, instr'man, Quebec & Saguenay Ry.; 1920 to date, divn. engr., Dept. of Roads, Prov. of Quebec.

References: A. J. Macdonald, C. E. Gauvin, G. K. Addie, J. N. R. Beaudet, A. Dick, R. J. L. Savary.

CRANDALL—WILLIAM HENRY, of Moncton, N.B. Born at Moncton, June 16th, 1892; Educ., Private instruction elect'l engr'g.; 1912-13, rodman & asst. dftsman. on constrn., N.T.C. Ry., Cochrane, Ont.; 1913-14, asst. to heating engr., Metals Ltd., Calgary, Alta.; 1914-15, asst. dftsman, prelim. surveys, Can. Govt. Ry. in Nova Scotia; At present, asst. to engr., The T. Eaton Co. Ltd., Moncton.

References: W. B. MacKenzie, J. Edington, J. D. McBeath, G. H. Butler.

DOAN—WILLIAM EARL, of Toronto, Ont. Born at Sabina, Ohio, March 6th, 1882; Vice-President, Canada Creosoting Co., Ltd., engaged in treating cross ties, timbers, and other materials for the railroads, power companies and others using these materials.

References: J. M. R. Fairbairn, A. C. MacKenzie, H. T. Hazen, R. L. Latham, S. B Clement.

DOHERTY—GEORGE WILLIAM, of East Wabana, Nfld. Born at Cardigan, P.E.I., April 23rd, 1879; Educ., Armour Inst. of Technology; 1898-99, wiring & install'n., small plants with contractor in Halifax; 1899-1902, electrn. & engr. at International Pier Lighting Plant, Dominion Coal Co.; 1902-04. general electric insp'r., Dominion Iron & Steel Co., Sydney; 1904, engr., Cape Breton Electric Co., Sydney; 1905, engr. in charge of plant at Winnipeg, Manitoba Free Press; 1907 to date, with Dominion Iron & Steel Co. as follows:—1907-10, foreman, electric repairs. 1910-19, asst. elect'l supt., Sydney. 1919 to date, erecting at Wabana Mines, Nfld.

References: J. B. Gilliatt, C. B. Archibald, J. H. Morley, J. B. Petrie, S. C. Mifflen, D. H. McDougall, J. S. Whyte.

DOREY—GEORGE BINET, of Montreal. Born at Jersey, Channel Islands, July 5th, 1888; Educ., I.C.S. and home study; 1907 to date (with exception of military service), with the Hart-Otis Car Co. as follows:—1907-10, dftsman, 1911 (6 mos.), inspector, 1911-12, in charge of detailing and checking of drawings & compilation of bills of materials, 1912-17 and 1919 to date, chief dftsman. In full charge of designing, erection & shop work; 1917-19, overseas, Lieut., 4th Can. Heavy Bty.

References: W. S. Atwood, C. M. McKergow, W. L. Scott, E. Vinet, T. C. McConkey.

DUNBAR—WILLIAM BOWIE, of Dunbarton, Ont. Born at Pickering, Ont., Aug. 8th, 1890; Educ., B.A.Sc., Univ. of Toronto, 1912; 1909 (summer), dftsman., C.P.R. constrn. office, Toronto; 1910 (summer), C.N.R. constrn.; 1911 (summer), concrete constrn. for self, sidewalks, etc.; 1912, res. engr., Board of Highway Comm'ors., York Co., & res. engr., pavement & storm sewers, Town of North Toronto; 1912-14, Toronto Power Co., Transmission line constrn.; 1915 (Apr.-Oct.), res. engr., Board of Highway Comm'ners., York Co.; 1915-17, munition insp'r., Canadian Inspection Co., in charge of shops at Belleville, Preston, Toronto; 1917-19, Lieut., Can. Engrs.; Summer 1920, reinforced concrete bldg. design & dfting.; Sessions 1919-20 and 1920-21, demonstrator in drawing, Faculty of Applied Science. Univ. of Toronto.

References: C. R. Young, P. Gillespie, J. R. Cockburn, T. R. Loudon, E. A. James C. S. L. Hertzberg.

DRAKE—EDWARD FISHER, of Ottawa, Ont. Born at Troy, Ohio, U.S.A., July 15th, 1862, Educ., Private tuition and specialized study; 15 years (1906-21), study of law & engineering as applied to irrig. drainage and water supply work, 1912-18, supt. in responsible charge of the irrig. branch, Dept. of the Interior, 1918 to date, Director in responsible charge of the Reclamation Service, Dept. of the Interior, Ottawa

References: J. B. Challies, G. N. Houston, O. S. Finnie, C. A. Magrath, J. Murphy, H. B. Muckleston, L. C. Charlesworth. C. H. Mitchell.

FORMAN—ANDREW SHEARER, of Westmount, Que. Born at Montreal, Que., July 26th, 1878; Educ., B.Sc., McGill Univ., 1901; With John Forman & Sons for 18 years, as mgr. & consltg. engr., in charge of elect. power & light install'ns., pulp & paper mill erection, water power development at Grand Mere, Shawinigan Falls, Jacques Cartier River; At present consltg. engr. in mech., elect'l and marine work.

References: J. H. Hunter, S F. Rutherford, F. Thomson, R M. Wilson, J. A. Shaw, C. Thomson, R. J. Beausoleil.

GEALE—HERBERT JOHN, of Toronto, Ont. Born at Montreal, Que., Sept. 30th, 1888; Educ., Senior Matric. Jarvis College, Toronto; 1908-12, with N.T.C. Ry. as follows:—1906-08, cachekeeper, 1908-09, timekpr., 1909-10, rodman, 1910-12, instr'man (acting res. engr. from Dec. 1911 to August 1912); 1912-14, instr'man, & 1914-15, leveller, C.P.R.; 1915-19, overseas; 1919-20, with Dupont Engineering Co., as instr'man in charge of layout at the General Motors Plant, Oshawa, Ont.; At present temporarily employed by the Toronto Transportation Comm'n. on street railway statistics.

References: T. S. Armstrong, W. P. Wilgar, H. H. Charles, A. C. Wright, S. B. McConnell, A. V. Redmond, W. O. Cudworth.

GRAHAM—FRANK CHARLES, of Port Arthur, Ont. Born at Broadview, Sask., Feb. 14th, 1891; 1908 to date, with City of Port Arthur as rodman, instr'man, insp'r., dftsman, and at present asst. city engr

References: W. T. Moodie, C. E. Henderson, L. M. Jones, G. R. Duncan, G. Blanchard.

HARRIES—JOHN FRANCIS, of Montreal, Que. Born at Cardiff, South Wales, Aug. 9th, 1889; Educ., B.S.A., Univ. of Toronto, 1910; Ap'ticed to his Father at Cardiff, Wales, in chem. engr'g., 1903-06; 1910 to date with Canada Starch Co. Ltd., as follows:—1910-12, in charge of laboratory, Cardinal, Ont., 1912-15, chem. supt. in charge of chem. process, Cardinal Plant, 1915-18, supt. of plant & designer of plant apparatus, Cardinal, 1918-20, chem. engr. in charge of all process & plants. May 1920 to date, chief asst. to chief engr., J. H. Hunter.

References: J. H. Hunter, R. E. Hunter, R. Bickerdike, R. J. Beausoleil, C. Thomson.

HICKS—WILLIAM ARTHUR BEAVER, of Montreal, Que. Born at London, Ont., July 31st, 1876; Educ., Grad. S.P.S. (Mech. & Elec. Engr'g.), Univ. of Toronto, 1897; 1898-1900, in shops & offices of Northey Co., Toronto; 1900-01, dfting dept., Snow Steam Pump Works, Buffalo, N.Y.; 1901-03, engine dept., Lackawanna Steel Co., on equipment & mtce of new power plant for steel mill, design of rolling mill and gas engines, piping systems, power tests etc.; 1904-20, hydraulic dept., S. P. Morris Co., more recently known as The J. P. Morris Dept. of the Wm. Cramp & Sons Ship & Engine Bldg. Co., Philadelphia, Pa., 1906-17, chief dftsman, 1917-20, asst. to mgr., designing, constructing & selling hydraulic turbines of all types & sizes; At present engr. of hydraulic dept., Dominion Engr'g. Works, Lachine, Que.

References: G. E. Bell, K. B. Thornton, H. Holgate, C. W. Larner, N. R. Gibson.

HIGGINS—EDGAR CLARENCE, of Toronto, Ont. Born at Montreal, Que., March 28th, 1894; Educ., 4 years Montreal Technical Evening Classes; 2 years course in struct'l engr'g. given by Dominion Bridge Co.; 1912-19, with Dominion Bridge Co. as follows:—1912-15, detailing & struct'l steel dept., detailing, checking & designing, plant engr'g office, 1918-19, detailing & checking, mech. drawing office; 1919-20, struct'l detailing, The Phœnix Bridge & Iron Works Ltd., Montreal; 1920-21, struct'l designing & checking, Can. Allis Chalmers Co. Ltd., Toronto; At present, checking, detailing etc., struct'l steel & gen bldg. work for the H.E.P.C. of Ontario.

References: D. C. Tennant, H. S. Grove, C. H. Timm, J. P. Watson, H. M. White, J. L. Brower, H. V. Armstrong.

HIRSCH—LYNN IRVING, of Toronto, Ont. Born at Philadelphia, Pa., U.S.A., April 11th, 1881; 1901-11, on various railroads in U.S.A. as follows:—1901-03, rodman, mtce of way, & instr'man on heavy constrn., 1903-05, dftsman, topog'r and leveller on prelim. & location surveys, 1905 (May-Sept.), transitman, 1905-06, dftsman, 1907 (Jan.-June), topog'r. & dftsman., 1907-09, chief dftsman for divn. engr., 1909-10, chief dftsman for engr. of constrn., 1910 (Apr.-July), asst. engr., grade revision, 1910-11, leveller on location; 1910 (Aug.-Oct.), chief of party, Benham Investment Co., topographic survey & subdivn. of 2000 acres; 1911-15, asst. engr., G.T.R., Toronto Grade Separation; 1915 to date, asst. supt. of constrn., Toronto Terminals Ry., New Union Stn., Toronto.

References: J. R. W. Ambrose. E. G. Hewson, A. S. Going, W. J. Armstrong, A. Crumpton.

JOST—ALLAN D., of Sydney, N.S. Born at Halifax, N.S., Aug. 1st, 1873; 1902 to date, with Dominion Iron & Steel Co. as follows:—1902-08, mech. dfting & designing, field engr'g. dept., 1909-20, asst. field engr., 1920 to date, field engr. & asst. supt. tracks & mtce.

References: C. M. Odell, G. D. Macdougall, A.W. McMaster, H. Longley, K. G. Cameron, D. F. MacIsaac.

JULIAN—FENNELL THOMPSON, of Morrisburg, Ont. Born at Castlemore, Ont., Aug. 31st, 1896; Educ., B.A.Sc., Univ. of Toronto, 1920; Summers 1914-15, gen. work & timekeeping on constrn. of county roads, Peel County; 1916-19, overseas; At present with H.E.P.C., Morrisburg. St. Lawrence River Development. Inst'-work, metering and office work on hydraulic computations.

References: M. C. Hendry, J. J. Traill, S. Bowen, C. H. Mathewson, C. R. McCort, P. Gillespie.

KENDALL—HERBERT CROSBY, of Toronto, Ont. Born at Milford, N.H., U.S.A., Sept. 16th, 1891; Educ., B.Sc. (E.E.), Queen's Univ., 1917; April 1917 to April 1918 and July 1919 to Nov. 1920, dftsman, chief mech. engr's staff, C.P.R.; 1918-19, overseas, U.S. Army; At present, bldg. & mech. supt., New Union Stn., Toronto Terminals Ry. Co.

References: J. R. W. Ambrose, W. J. Armstrong, A. L. Mudge, J. A. Shaw, W. H. Winterrowd, G. R. Jack.

KIRBY—ALBERT RUSSELL, of Shelburne, Ont. Born at Toronto, Ont., March 21st, 1899; Educ., 4 years Tech. High School, Toronto; 2 years, dftsman., & junior instr'man, mtce. of way, G.T.R. in Ontario; 2 years, transitman, Toronto Harbor Comm'n.; 6 mos. to date, asst. to the res. engr., Toronto-Owen Sound Prov. Highway.

References: F. B. Goedike, I. F. Willsie, E. G. Hewson, N. D. Wilson, G. Hogarth.

LEE—WILLIAM DAVID, of Winnipeg, Man. Born at Cork, Ireland, June 1st, 1883; 1909-14, with C.P.R. as follows:—1909-10, right of way surveys, rodman on constrn. instr'man in charge of constrn. as res. engr. 1913-14, res. engr. constrn. dept.; 1917-18, res. engr., Winnipeg Aqueduct Constn. Co.; 1919 to date, res. engr., constrn. dept., C.P.R.

References: W. A. James, D. A. Livingston, J. C. Holden, W. G. Chace, J. A. Meindl.

LePAN ARTHUR D'ORR, of Toronto, Ont. Born at Owen Sound, Ont., Aug. 20th, 1885; Educ., B.A.Sc., Univ. of Toronto, 1908; 1909 (5 mos.), asst. engr., filtration plant, etc., under R. McDowell, C.E., Town of Owen Sound; 1910, appointed asst. supt., 1915, joint supt., 1920, supt., of University of Toronto. Work included constrn. of stands seating 8000 people at the Univ. of Toronto Stadium, constrn. of concrete & brick tunnell extension, steam mains & wiring, to connect Knox College with Central Plant; At present in complete charge of operation, mtce, alterations & additions to central heating plant.

References: C. R. Young, P. Gillespie, J. R. Cockburn, T. R. London, C. H. Mitchell, W. B. Redfern, G. T. Clark, W. R. Worthington.

MacRAE—ALEXANDER ERNEST, of Ottawa, Ont. Born at Avonmore, Ont., Nov. 19th, 1887; Educ., B.Sc. (Chem. Engr.), Queen's Univ. 1914. Fellow-Canadian Institute of Chemistry. Member-Society of Chemical Industry; 1912-14, tutor (demonstrator for 3 mos.) in chemistry, Queen's University; 1913 (summer), asst. engr., Metallurgical Research Dept. of the Canadian Copper Co., Copper Cliff, Ont.; 1914 (summer), asst. chemist, Mond Nickel Co., Coniston, Ont.; 1914 to date, examiner in charge of the Chemical & Metallurgical Division of the Canadian Patent Office, Ottawa.

References: A. Macphail, L. W. Gill, K. M. Cameron, W. L. Malcolm, D. A. R. McCannel, F. G. Bird.

MAGUIRE—HUGH CHRISTOPHER, of St. Catharines, Ont. Born at St. Catharines, Feb. 19th, 1880; Educ., 3 years Univ. of Toronto, 1903-06; 1906-11, engr'g staff, Welland Canal. On constrn. of dock, retaining walls, dredging etc.; 1911-13, prelim. survey for Welland Ship Canal; 1913-17, junior engr. in charge of constrn. work on south half of Section 5, Welland Ship Canal; 1917-18, engr. with Foundation Co. on constrn. of International Nickel Co's plant at Port Colborne, Ont.; 1918-19, engr. with Foundation Co. at Tulleytown, Pa.; 1919, in charge of party on land survey work for Mr. Rutherford, O.L.S.; At present, junior engr., Section No 5, Welland Ship Canal.

References: H. G. Acres, W. P. Near, W. H. Sullivan, E. P. Johnson, R. P. Johnson, J. J. Aldred, D. E. O'Brien, R. C. Morgan.

McADAM—JAMES, of Toronto, Ont. Born at Edinburgh, Scotland, July 7th, 1882; Educ., Heriot Watt Tech. College, 1898-1902, Qual. Sanitary Inspector by exam., Royal Sanitary Institute, 1905; 5 yrs. ap'ticeship in quantity surveying & engr'g., 1898-1902; 1903-04, junior asst. engr., Edinburgh & District Water Trust; 1905-07, engr. & surveyor on the Scotch Estates of the Most Hon., The Marquis of Zetland, K.T.; 1907-09, town engr. & sanitary insp'r. of Lochgelly, Fife, Scotland; 1910-19, with roadway section, Works Dept., City of Toronto, as follows:—1910, dftsman, 1911, asst. outside insp'r of work, 1912-15, engr. of West Division, 1915-19, engr. in charge of all contract work on roadways & sidewalks; 1919 to date, engr. of constrn. for Messrs. Barber, Wynne-Roberts & Seymour, Consltg. Engrs., Toronto.

References: R. O. Wynne-Roberts, H. L. Seymour, F. Barber, G. G. Powell, R. H. H. Blackwell, W. Barber, W. R. Worthington.

McKINNON—RONALD MORRISON, of Sydney, N.S. Born at Sydney River, C.B., N.S., May 22nd, 1885, Educ., B.Sc., Dalhousie & N.S. Tech. College. 1912, Surveying, dfting, & estimating for Sydney Paving & Constrn. Co.; 1912-16, asst. to City engr., City of Sydney; 1916-19, acting city engr., City of Sydney, in charge of munic. work, 1919-21, dfting & struct'l steel designing, estimating & in charge of constrn., Cape Breton Engr'g. Works; At present City engr., City of Sydney.

References: C. M. Odell, D. H. McDougall, D. Morrison, H. F. Laurence, J. R. Morrison.

McNEIL—RICHARD JOHN, of Sydney, N.S. Born at Halifax, N.S., Sept 20th, 1882; 2 years Student with American Coke & Gas Co.; 4 years rodman & instr'-man, 10 years field engr., on gen'l constrn., Dominion Iron & Steel Co.; At present asst. to supt. of mtce of way, Dominion Steel & Coal Co.

References: G. D. Macdougall, A. W. McMaster, J. R. Morrison, H. Longley, D. F. MacIsaac, D. H. McDougall.

McNIVEN—JOHN J., of Ottawa, Ont. Born at Manitou, Man., March 21st, 1886; Educ., B.Sc., McGill Univ., 1912; 1909-14, with B.C. Electric Rly. Co., Vancouver, B.C., as follows:— 1909 (summer), rodman on survey work, 1910 (summer), oiler & asst. operator, hydro electric generating stn. 1911 (summer), constrn. insp'r. & foreman, 1912-13, dfting & designing, power plants & substns. 1913 (Jan.-Mar.), insp'r on constrn. steam power plant; 1913-14, asst. to elect'l engr.; 1914-17, inspector, Gas & Electricity, Dom. Govt.; 1918-20, western mech. engr., D.S.C.R., in charge of operation, mtce & new constrn. of power & heating plants, Oct. 1920 to date, gen'l mech. engr. of above dept., with jurisdiction over all power & heating plants throughout Canada.

References: N. F. Parkinson, G. A. Browne, F. S. Keith, H. S. Johnston, R. A. C. Henry, F. S. Easton, E. A. Jamieson.

MYLES—ALBERT RUSSEL, of Campbellton, N.B. Born at Albert, N.B., Oct. 17th, 1899; 1914-17, divn., engr's office, C.N.R., Campbellton; 1917 to date, rodman on above staff.

References: R. H. Smith, R. A. Black, W. R. Campbell, R. J. S. Sly, J. L. Wilson, R. McManus.

MOGAN—JAMES THOMAS, of Toronto, Ont. Born at Toronto, June 7th, 1894; Educ., B.A.Sc., Univ. of Toronto, 1915; 1912-13 (summers), rodman, City of Toronto; 1914 (summer), field engr., Toronto Harbor Comm'n.; 1915, in charge of survey party, Toronto Harbor Comm'n.; 1916 (Jan.-May), mtce. of way, Buffalo Divn., Lehigh Valley Rly.; 1916-17, field engr., Canadian Stewart Co., Toronto Harbor Improvement contract; April 1919 to date, field engr. in charge of constrn., Russell & Roddick, Marine Contractors, Toronto Harbor Improvements.

References: H. R. Silcox, C. L. Hays, N. D. Wilson, G. T. Clark, W. E. M. Bonn, R. G. Saunders.

MONTABONE—ADOLPH JALBERT FLEMMING, of Montreal, Que. Born at Rockville, Ind., U.S.A., Dec. 30th, 1879; Engaged in practical work in the elect'l engr'g field from the age of 14 years; 1904-14, dist. elect'l engr. for C.G.E. Co. Ltd., Montreal; 1914 to date, consltg. elect'l engr. in connection with pulp & paper industry.

References: L. A. Herdt, N. C. Mills, H. S. Ferguson, W. J. Francis, F. B. Brown, J. M. Robertson, C. W. Burroughs.

MORHAM—WILLIAM CUNNINGHAM, of Toronto, Ont. Born at Edinburgh, Scotland, April 18th, 1879; Educ., 1st year engr'g course at Heriot Watt College, Edinburgh, Classes there and at School of Art during architectural ap'tice-ship; 1896-1901, ap'tice with Dunn & Findlay, Edinburgh; 1901-03, dftsman, city engr's office, Edinburgh; 1903-05, dftsman, Runtz & Ford, Arch'ts., London, England; 1905-07, city engr's office, Edinburgh; 1907-09, asst. arch't., city engr's office, Singapore; 1913-14, dftsman, prov. arch'ts office, Toronto; 1916-17, dftsman, Sutcliffe & Neelands, Engrs., New Liskeard, Ont.; 1919, dftsman, Sharp & Horner, Arch'ts., Toronto; Oct. 1919 to date, dftsman, hydraulic dept., H.E.P.C. of Ontario, Toronto.

References: T. H. Hogg, M. V. Sauer, R. L. Hearn, J. R. Montague, W. Harland, A. E. Nourse.

MOORHOUSE—EDMUND FLOYD, of Winnipeg, Man. Born at Richmond, Ont., Jan. 20th, 1895; Educ., B.Sc. (C.E.), Univ. of Toronto, 1920; 1911, rodman, City of Medicine Hat, Alta.; 1912, asst. topog'r., C.P.R.; 1914, timekpr., South Alberta Land Co.; 1915, rodman, D.L.S. in Sask., 1916-17, asst., D.L.S. in Alta & Sask.; 1919, location party, Canada Land & Irrig. Co., Alta.; 1920 (Apr.-Sept.), struct'l dftsman, Lockwood, Greene & Co., Detroit, Mich.; 1920-21, demonstrator, Engr'g Dept., Univ. of Manitoba.

References: G. C. Cowper, J. D. McBeath, R. W. Moffat, J. N. Finlayson, P. Gillespie, V. M. Meek, J. L. Franzen.

NIVEN—CHARLES RITCHIE, of Toronto, Ont. Born at Belfast, Ireland, Aug. 10th, 1898; Educ., 3rd year engr'g cert., Technical College, 1920; 1915-20, yard plant dftsman., on reconstrn. of shipyard, Harland & Wolff Ltd., Shipbldrs., Glasgow, Scotland; Nov. 1920 to date, dftsman, constrn. dept., H.E.P.C. of Ontario, Toronto.

References: M. V. Sauer, F. A. Robertson, W. Harland, A. E. Nourse, R. M. Carmichael.

OLMSTED—REGINALD I., of Calgary, Alta. Born at Ancaster, Ont., Oct. 10th, 1889; Educ., I.C.S. Munic. Engr'g.; 1910-11, rodman & instr'man, cement tesing, Smith Kerry & Chace, Horseshoe Falls, Alta.; 1912-13, instr'man, Calgary Power Co. Ltd.; 1914 (Feb.-July), timekpr., Foundation Co. Ltd., Bear River, N.S. & Niagara Falls, N.Y.; 1914-15, instr'man, American Aluminum Co., Massena Springs, & New York City; 1915 (May-Dec.), rodman, Welland Ship Canal, Sec. 1; 1915-19, overseas; 1919 (Apr.-July), foreman, Canadian Dredging Co., Port Robinson, & H. E. P. C. of Ontario, Nipegon, Ont.; July 1919 to date, res. supt., engr'g branch, D.S.C.R., one year at Victoria, B.C. and at present at Calgary, Alta.

References: H. S. Johnston, G. A. Browne, J. Adam, A. G. Willson, C. W. Allen.

PALSER—HUGH DEARLE, of Gowganda, Ont. Born at London, England, July 14th, 1884; Educ., 3 years scholarship, The Walthamstown Essex Technical School, London, England; 1902-06 ap'ticeship with Henry Jones & Sons, Gen. Engrs., London; 1906-08, charge of constrn. & repairs, The Farman Auto Co., London; 1908-10, engr. to Plaw Hatch Estate, Sussex, England. Charge of electric light plant, pumping install'n., and other mach.; 1913-15 assayer & surveyor, The Miller Lake O'Brien Mine; 1915 to date, engr. with The Miller Lake O'Brien Mine, Gowganda, Ont.

References: J. A. Reid, J. G. Dickenson, H. W. Sutcliffe, A. D. Campbell, F. D. Reid, A. V. Redmond.

PARKER—IRVING HOLMAN, of Montreal, Que. Born at New York City, U.S.A., June 9th, 1893; Educ., 1920-21, (unfinished to date), High way Engr'g Course, including Laboratory Research, Univ. of Michigan; 1913-16, rodman, leveller, transitman, on field constrn. work on elevated R.R. for Itnerborough Rapid Transit Co., New York City; 1917-19, with U.S. Army, 22 mos. in France with Arco Service, Wounded, Awarded Croix de Guerre, 1918; 1919 to date, with Milton Hersey Co., Ltd., Montreal, Season 1919 in charge of street and plant inspection, Quebec City, Season 1920 in charge of plant inspectors and street inspection, Montreal; At present on leave of absence until June 1st, to attend advanced courses and seventh Annual Conference of Highway Engineers, held at the Univ. of Michigan, Ann. Arbor, Mich.

References: C. A. Mullen, A. H. Blanchard, R. A. Ross, W. D. Baillairge.

PHILLIPS—FREDERICK ROBERT, of Toronto, Ont. Born at Rye, Sussex, England, April 25th, 1887; Educ., Honours Diploma, Quantity Surveying. City & Guilds Institute, London, England; 1902-07, with Ellis Bros., Contractors. Rye, Sussex, as asst. on design, quantities & estimating; 1907-10, dftsman & estimating, Batts Ltd., Toronto; 1910-12, struct'l supt., John M. Lyle, Architect; 1912-14, with John Ver-Mehr Co. and William Cowlin & Sons, Toronto, on design of superstructure for new filtration plant, Toronto, and layout & supervision of brickwork, masonry & reinforced concrete on job; 1915-18, with British Forgings Ltd., on general layout of plant, design of bldgs., foundations & high pressure hydraulics, and supt. of install'n of mach., also chief designer during operation. Also during this period inspection & report on Curtis Forge & Machine Plant, St. Louis, Mo. (methods & equipment); 1918-19, with Roger Miller & Sons, Toronto, Design & charge of layout for rolling mill foundations & bldgs. for Baldwin Steel Corpn., Toronto; Jan. 1920 to date, chief engr., for L. E. Dowling, Constrn. Engr., Toronto.

References: E. Gibson, W. E. M. Bonn, N. S. C. Bothwell, R. O. Wynne-Roberts, E. L. Cousins.

PLUNKETT—THOMAS H., of Meaford, Ont. Born at Meaford, June 1st, 1879; Educ., B.A.Sc., Univ. of Toronto, 1904; D.L.S. 1908; 1901, 4 mos., dftsman, 2 mos., transitman, prelim. survey, proposed Manitoulin & North Shore Rly. Meaford to Owen Sound; 1903-05 (3 years), first asst. to D. L. Surveyors; 1905 (July-Dec.), dftsman, C.N.R.; 1906 (Jan. to June), prelim. & location of proposed Haliburton Whitney Rly. Res. engr. on constrn. on above work until Aug. 1906; 1906-07, res. engr. on Toronto-Sudbury Branch C.N.R.; 1907-08, Fellow, Faculty of Engr'g., Univ. of Toronto; 1908-10, in charge of Dominion Land Subdivision parties in B.C.; 1911-20, in charge of Dominion Govt. Base Line & Meridian Surveys; At present Chairman of Committee to supervise the constrn. of 2¼ miles of reinforced concrete pavement in the Town of Meaford, estimated cost $142,000.

References: C. R. Young, P. Gillespie, G. B. Dodge, E. W. Oliver. A. F. Stewart, J. F. Fredette.

RICHARDSON—BERTRAM POIDEVIN, of Amherst. N.S. Born at Lee, Kent, England, May 5th, 1872; Member Transvaal Inst. of Mech. Engrs. which is affiliated with the British Institute; 5 years ap'ticeship as mech. engr. with Jos. Thompson & Sons Ltd., Engrs. & Shipbldrs., London & Sunderland, England; 1900-02, supt. of military works for The Orange Free State under Gen. Baden Powell, during the South African War. Design & constrn. of barracks, hospitals, install'n & mtce. of water supplies etc.; 1902-04, res. engr. in charge of constrn., The Kroonstad Breweries Ltd.; 1905, contractor for and in sole charge of boring for water and the supply and install'n of pumping mach., along 40 miles of new rly. (Bethlehem to Kroonstad) for the Natal Govt. Rlys.; 1906-11, designer & constrn. engr. for The Consolidated Goldfields Ltd., H. Eckstein & Co. and The Premier Diamond Mines Ltd. During this period also designed a new boiler plant for La Compagnie Generale d'Electricité de Lourenco Marques, Portugese East Africa; 1912-14, asst. to J. A. Jamieson, Montreal, designing grain elevators, & res. engr. in charge of constrn. for Ross & Macdonald, Arch'ts. & Engrs.. Montreal; 1914-19, overseas, France & Belgium, Major, Can. Rly. Constrn. Corps, under Col. C. W. P. Ramsey, C.M.G.; 1919 to date, res. engr., for Lockwood Greene & Co. of Canada Ltd., Montreal.

References: E. G. Horne, C. W. P. Ramsey, D. Hillman, C. L. Hervey, A D. Swan, J. A. Jamieson, R. Mudge.

ROSE—FREDERICK ARNOLD, of Vancouver. B.C. Born at London, England, Feb. 19th, 1881; 1906-07, instr'man, Los Angeles Aqueduct; 1907, instr'man, Milwaukee & St. Paul R.R.; 1907-08, in charge of party land surveying under J. H. Brownlee, C.E., D.L.S.; 1908-09, instr'man on land reclamation, Sumas Development Co.; 1909-11, in charge of parties locating & constructing govt. roads in B.C. under H. T. Twigg, A. J. Hill & A. P. Augustine; 1911-14, not engaged in engr'g work; 1914-16, Lieut., C.E.F. Wounded 1915. Discharged permanently unfit 1916; 1917, officer in charge of military hospital, Vancouver, B.C.; 1917-18, with G. A. Martin, C.E. laying & constructing govt. roads in New Zealand; Two years Supervisor of Therapeutical Training for the Prov. of B.C. under D.S.C.R., an appointment recently dispensed with.

References: W. H. Powell, J. W. B. Blackman, C. S. Manchester, H. F..V. Meurling, A. P. Augustine.

RUTTER—WALTER AYBURNE, of Toronto, Ont. Born at London, England, May 28th, 1887; Educ., B.Sc. (M.E.), Univ. of London, 1909; School of Marine Engr'g, London, England; Full shop ap'ticeship work in summers; 1 year designing instruments & gen. dfting work with A. Gallenkamp & Co. Ltd., London; 6 mos. installing factory equipment for T. Wiley, Arch't., St. Catharines, Ont.; 1911-14, chief dftsman, & supt. of constrn., Canadian Kodak Co. Ltd., Toronto; 1914-17, with above firm as asst. gen. supt. in charge of power & industrial plant; 1917 to date, chief engr., Canadian Milk Products Ltd., Toronto, I year to date, vice-pres. & chief engr.

References: G. G. Powell, C. B. Hamilton, Jr., P. Gillespie, F. B. Goedike.

SCARNEGIE—DANIEL ANTHONY, of Montreal, Que. Born at New York, N.Y., Oct. 19th, 1888; Educ., Mech.-Elec. Engr., Mass. Inst. of Technology, 1907; 1907-09, ap'ticeship at General Electric Co., Lynn, Mass.; 1909-11, designing tools & jigs, Lozier Motor Works, Plattsburgh, N.Y.; 1911-14, dftsman, engr'g dept., G.T.R.; 1914-19, overseas, Lieut. Can. Engrs., location & constrn of narrow gauge rlys., etc. Completed course of instructions in design & constrn. of aircraft, R.A.F.; At present chief signal dftsman, G.T.R.

References: F. L. C. Bond, A. S. Going, J. A. Burnett, L. Gibson, R. Armour.

SKINNER—EDWARD WILLIAM, of Kingston, Ont. Born at Hamford Hill, London, England, April 27th, 1877; Educ., People's Palace Tech. Sdhool (East London Tech. College), London, England, 1888-92, 2 years, Arts, Queen's University; Ap'ticeship to mach. shop work & dfting., Brinjee & Goodwin, Mech. Engrs., London; 3 years, erecting pump. & hydraulic mach. with Glenfield & Kennedy Co. Ltd., Kilmarnock, N.B.; 11 years dftsman with Can. Locomotive Co. Ltd., Kingston, Ont., 3 years in charge of during reconstrn. of works, of all location & alteration to mach't. tools, drives, crane facilities etc.; 4 years war service as comm'd officer, 2 years on alien Internment operations at Fort Henry, Ont., 2 years overseas, 15th Bn., for a time Brigade Works Officer; Official Censor in Battn. Area Occupied Zone in Germany, Adjt. "Price of Wales Own Regt." Kingston, 1919-20; Oct. 1920 to date, asst. Dept. of Drawing, Faculty of Applied Science, Queen's University, Kingston.

References: A. Macphail, W. P. Wilgar, D. S. Ellis, L. M. Arkley, L. T. Rutledge.

SPIDY—EDGAR THOMAS, of Montreal, Que. Born at Brighton England, March 18th, 1887; Educ., Mech. engr. course, Brighton Tech. College, completed 1907; Assoc. Member, Amer. Soc. Mech. Engrs.; Ap'tice, London, Brighton & South Coast Rly., Brighton Works, England; 1909-17, with C.P.R. as follows:—1909-11, piece rate setter & instruction card insp'r., Angus Shops, Montreal, 1911 (Jan.-July), asst. gen'l. foreman, in charge of efficiency work, Toronto Shops, 1911-15, same position, Winnipeg Shops, 1915-17, shops engr., Winnipeg Shops, Lecturer in mech. engr'g., Univ. of Manitoba, session 1916-17, in conjunction with C.R.P. work; 1917, production engr., Canadian Ingersoll Rand Co., Sherbrooke, Que.; 1918, production engr., Angus Shops, Montreal; March 1921, appointed asst. supt., Dominion Engr'g. Works, Rockfield, Que.

References: H. V. Haight, S. R. Newton, W. H. Winterrowd, J. A. Shaw, M. T. Cantell, E. E. Brydone-Jack, H. H. Vaughan, E. S. Winslow.

SPROULE—FREDERIC ARNOLD, of Kingston, Ont. Born at Newington, Ont., June 26th, 1894; Educ., At present 4th year Student Queen's University; 1913 (summer), rodman, reclamation service, Dept. of the Interior; 1914 (summer), chief instr'man reclam. service, Dept. of the Interior; 1914-15, junior engr. with T. H. Dunn, D.L.S., O.L.S., Dom. Water Power Branch; 1916-19, overseas, comm'n gazetted with C.F.A., 1917; 1920 (summer), hydrographer, Nor. Ontario Dist., under Hydrometric Surveys of the Dominion Power Board.

References: T. H. Dunn, G. G. McEwen, J. R. Bissett, W. P. Wilgar, A. Macphail, W. L. Malcolm.

STEWART—JOHN ROBERTSON, of Renfrew, Ont. Born at McNab, Renfrew Co., Ont., Sept. 10th, 1861; 1886-92, stationary engr.; 1892-1900, in charge of Renfrew Electric Light Station; 1900-03, waterworks insp'r & street overseer, Town of Renfrew; 1903 to date, town engr., Renfrew, 1910-11, built the munic. power & light plant & waterworks pumping station under J. B. McRae, Ottawa; Since 1911, supervision of design & constrn. of all waterworks & sewer extensions to the town system, roads, bridges, etc.

References: J. B. McRae, J. G. G. Kerry, H. G. Acres, T. H. Hogg, J. L. Morris.

THOMPSON—PHILIP MANLY, of Toronto, Ont. Born at Hallowell, Ont., Aug. 28th, 1878; Educ., B.A.Sc., Univ. of Toronto, 1908; 1907 (summer), rodman, U.S. Steel Corpn., Youngstown, Ohio; 1908-09, dftsman, arch'ts branch, D.P.W., Ottawa; 1909 (Apr.-Sept., dftsman on struct'l steel work, Riter-Corley Mfg. Co., Pittsburgh, Pa.; 1909-11, dftsman on struct'l steel work & assembler & fitter on shop work, American Bridge Co., Ambridge, Pa.; 1911 (May-Dec.), dftsman on struct'l steel. Canada Foundry Co., Toronto; 1912 to date, plan examiner, city arch'ts dept., City Hall, Toronto; At present. chief plan examiner.

References: A. E. Nourse, C. R. Young, T. H. Hogg, T. D. Mylrea, W. A. M. Cook.

TROTTER—WILLIAM BEAUCHAMP, of Calgary, Alta. Born at London, England, Feb. 29th, 1884; Diploma, Mech. engr'g., School of Engr'g., Regent St. Polytechnic, London, England, Silver Medallist-Honours, mach. design, diploma, marine engine design, Glasgow & West of Scotland Technical; 1901-05, ap'tice, David Rowan & Co., Marine Engine & Boilermakers, Glasgow, Scotland; 1905-06, works dftsman, same firm; 1906-10, 6th, 5th, 4th & sr. 4th marine engr., with R.M.S.P. Co., Tysee Line, Ltd.; 1910-17, engr., The James Ballantyne Co. Ltd., in charge of design & equipment of heating, ventilating & power install'ns., on the largest public bldgs. etc. throughout Western Canada; 1917-19, sales engr., The Spencer Boiler Co.; At present Manager, The James Ballantyne Co. Ltd., Calgary Branch, covering the province of Alberta.

References: A. Ingraham, R. S. Trowsdale, T. Kipp, H. S. Trotter, A. R. Greig, F. W. B. Scholefield.

TURNER—EDWIN STEWART, of Allenburg, Ont. Born at Toronto, Ont., March 19th, 1886; 1905-06, rodman, C.N.O. Ry., Toronto-Sudbury; 1907, rodman, C.P.R., Toronto-Sudbury; 1909-13, in charge of D. L. Survey parties in Sask., this also included considerable munic. work; 1919 (7 mos.), instr'man, Welland Ship Canal, 1919 to date, office engr., Section 5, Welland Ship Canal.

References: A. J. Grant, W. H. Sullivan, F. S. Lazier, R. C. Morgan, R. C. MacLachlan, G. H. Read.

VERNON—BRUCE, of Montreal, Que. Born at Philadelphia, Pa., U.S.A., Oct. 3rd, 1887; Educ., C.E. Pennsylvania Univ., 1908; 1908-15, with Dolce & Co., Philadelphia, as follows:—1908-12, dfting, estimating & designing of steel & reinforced concrete bldgs., 1912-14, in charge of all designs of steel & reinforced concrete bldgs., 1914-15, supt. in charge of all outside work; 1915-16, engr. in charge of design of paper mill & hydro-electric plant with Kerry & Chace, Toronto; 1916-18, engr. in charge of bldg. design & constrn., Montreal Tramways Co., Montreal; 1918 to date, principal asst. engr., Montreal Tramways Co.

References: K. B. Thornton, W. F. Graves, R. M. Hannaford, P. A. N. Seurot, D. E. Blair, G. R. MacLeod.

WALLIS—JAMES HAROLD, of Toronto, Ont. Born at San Francisco, Calif., April 24th, 1891; Educ., 3 years S.P.S., Univ. of Toronto, 1913. (Did not graduate on account of enlisting); 1919 (Jan.-June), senior engr'g class, Edinburgh Univ.; 1909, with J. W. Fitzgerald, C.E., O.L.S., and J. H. Burd, O.L.S., on township lines, Nor. Ontario; 1910-13 (summers), rodman, transitman & concrete insp'r., N.T.C. Ry.; 1913-14, transitman, mtce. of way, Atlantic Divn., C.P.R.; 1914-19, overseas. Enlisted as private, B.E.F. Promoted to Major; 1919-20, transitman, mtce. of way, Brownville Divn., C.P.R.; 1920 (June-Nov.), asst. engr., Dept. of Rlys., Grand Trunk Arbitration; Nov. 1920 to date, engr., Canada Creosoting Co., Head Office, Toronto.

References: J. M. R. Fairbairn, W. J. Francis, P. B. Motley, J. W. Orrock, C. C. Kirby, A. O. Wolff.

WALTON—MELVILLE RALPH, of Toronto, Ont. Born at Chicago, Ill., U.S.A., Feb. 25th, 1893; Educ., B.S. George Washington University, 1915; 1913-14 (summers), office of Public Roads, U.S. Dept. of Agric., survey party, highway constrn., material insp'n & testing; 1915 (July-Dec.), asst. engr. of tests, Toronto-Hamilton Highway Comm'n.; 1915-16 (4 mos.), insp'r., Canadian Inspection & Testing Co.; 1916-18, field engr., Canadian Stewart Co. Ltd. on Toronto Harbor Improvements; 1918 (Feb.-Aug.), asst. supt. with above; 1918-19, res. engr., Aviation Section, Imperial Munitions Board. In charge of constrn. & mtce work, Toronto; 1919-20, engr., Carswell Constrn. Co., Gen. Contractors, Toronto; 1920-21, engr., Russel-Towsend Co., Peterboro; Feb. 1921 to date, engr., Russell Constrn. Ltd., Toronto.

References: J. B. Carswell, W. E. P. Duncan, W. E. M. Bonn, H. R. Silcox, N. D. Wilson, C. L. Hays.

WILSON—WILLIAM SMITH, of Sydney, N.S. Born at Frodingham, Lincolnshire, England, Jan. 15th, 1894; Educ., Middlesborough Tech. College. 1910-12; 1911 to date (with exception of 1919-20 when efficiency engr., Dom. Coal Co.), with Dom. Iron & Steel Co., as follows:—1911-12, foundry practice, 1912-13, machine shop practice; 1913-17, mech. dftsman; 1917-18, asst. chief dftsman; 1918-19 & 1920 to date, tech. engr.

References: C. M. Odell, A. W. McMaster, G. D. Macdougall, D. Morrison, K. G. Cameron, D. F. MacIsaac.

WITHROW—J. FREDERICK D., of Ottawa, Ont. Born at Toronto, Ont., Feb. 25th, 1878; Educ., Grad. S.P.S. (mech. & elec. engr'g.), Univ. of Toronto, 1900; 1896, on topog'l. surveys for Speight & Nostrand, Toronto; 1897-1900 (summers), mach. shop, Massey Harris, Canada Foundry, Electric Ry. car repair shops, Toronto; 1900-01, dftsman, John Inglis Engine Works, Toronto; 1901-03, dftsman, engr. & asst. to supt., Illsley & Horn, Gen'l Bldg. Contractors, Toronto; 1903-05, dftsman. & asst. engr., Public Works of Canada, Toronto Office. Designed system of concrete piling (in situ). Invention taken up by Raymond Concrete Pile Co. Patented U.S. & Canada. Designed and built batch gravity concrete mixer. Patented U.S. & Canada; 1905 to date, examiner of patents of inventio, Patent Office, Ottawa.

References: J. B. Challies, R. S. Smart, A. P. Deroche. J. G. Sing, W. P. Merrick, C. M. Canniff, C. P. Edwards, J. Murphy, D. C. Tennant.

WOOD—REGINALD HENRY, of Halifax, N.S. Born at Plymonth, England, July 5th, 1869; Educ., Certs. in advanced steam, applied mechanics & mech. drawing from Tech. Schools, Devonport; 1884-90, engr'g ap'tice course at H. M. Dockyard, Devonport; 1890-1920 with H. M. Navy as follows:—1902-04, chief engr., Destroyers Thrasher & Salmon 1911-20 chief engr. of Esquimalt Dockyard, including tempory charge of the G.T.P. Dry Dock & Equipment at Prince Rupert, B.C., during 1915-16, while in use for repairs of large auxiliary & other cruisers; August 1920 to date, engineer manager of H.M.C. Dockyard, Halifax, N.S.

References: C. E. W. Dodwell, J. H. Pilsbury, W. H. Tobey, N. A. Yarrow, N. C. Sherman, A. F. Mitchell, W. A. Winfield, C. A. K. Cornwall.

WOOKEY—STANLEY ALFRED, of Schumacher, Ont. Born at Mandeville, Jamaica, B.W.I., Oct. 5th, 1886; Educ., B.A.Sc., Univ. of Toronto, 1910; 1906-11, asst. on geol. survey of Canada, 1910 in charge of topog'l party; 1911-12, surveyor, McIntyre Gold Mines; 1912-14, field engr., Frontenac Mica Co.; 1914-15, surveyor, Hollinger Gold Mines; 1916-18, mgr., Schumacher Gold Mines; 1918-19, Lieut., Can. Engrs.; 1919-20, supt. Plenaurum Gold Mines; 1920 to date, safety engr., McIntyre Porcupine Mines Ltd.

References: D. E. Keeley, H. E. T. Haultain, H. P. DePencier, W. F. J. Cosser, F. A. Bell.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

CROSBIE—HAMILTON TALBOT, of Yorkton, Sask. Born at Ardfert, Ireland, Feb. 2nd, 1870; 1893-99, evening classes, Glasgow Tech. College & Glasgow Univ.; 1893-98, apprenticed with Johnstone & Rankine, Civil & Mining Engrs., Glasgow; 1899; with Hyle Dennison & Fraser, C.E. & Land Surveyors, Glasgow, 1911, South African War; 1901, engr. for contractor on constrn. of Invergarry & Fort Augustus Rly., Scotland; 1902-04, with McKenzie & Mann on constrn. of Halifax & South Western Rly., N.S.; 1911-15, town engr., Yorkton, Sask.; 1916-18, lieut. Can. Engrs.; 1919 to date, town engr., Yorkton.

References: H. N. Ruttan, A. Smith, J. N. deStein, R. H. Murray, E. B. Webster.

KITTO—FRANKLIN HUGO, of Ottawa, Ont. Born at Brampton, Ont., March 28th, 1880; Educ., Special Course Alberta College & private tuition; D.L.S., 1908; 1905-06, articled pupil & asst. in office, Saunders & Driscoll, Civil Engrs. & D. L. Surveyors, Edmonton, Alta.; 1906, asst. city engr. & surveyor, Edmonton, Alta.; 1908-17, engaged in technical offices of the Dept. of the Interior except periods noted below, 1908 (5 mos.) & 1910 (1 mth.), In charge of D.L.S. parties in field; April 1911 to Aug. 1914, Director of Suveys, Yukon Territory. Charge of all offices and field surveys and part time Insp'r of Mines to local Highways Dept. & Engr. to City of Dawson; 1916 (3 mos.), in charge of D.L.S. party in field on survey to control mineral locations; April, 1917 to date, Exploratory Engr. for Natural Resources Intelligence Branch, Dept. of the Interior, Ottawa.

References: J. B. Challies, L. C. Charlesworth, L. H. Cole, J. D. Craig, O. S. Finnie, D. H. Nelles, N. J. Ogilvie, B. J. Saunders.

STRAUSS—JOSEPH BAERMANN, of Chicago, Ill., U.S.A. Born at Cincinnati, Ohio, Jan. 9th, 1870; Educ., Civil Engr., Univ. of Cincinnati, 1892; 1892-94, dftsman, New Jersey Steel & Iron Co., Trenton, N.J.; 1894-95, instructor, College of Engr'g., Univ. of Cincinnati; 1895-97, insp'r., detailer, designer, Lassie Bridge & Iron Works, Chicago; 1897-99, designer in charge, Sanitary District of Chicago; 1899-1902, principal asst. to Ralph Modjeski; 1902-04, consltg. engr., Chicago; 1904 to date, pres. & chief engr., Strauss Bascule Bridge Co. Preparation of plans & specifications for bascule & lift bridges of own design. Over 200 of these bridges have been built or are under constrn. in U.S., Canada and various parts of the world. Also designed and directed the building of the Aeroscope at the Panama Pacific Exposition; a new type of portable searchlight apparatus for the U.S. & Russian Govts; a type of yielding barrier in service at many points and a large number of concrete bridges and special concrete bldgs; At present also pres. & chief engr., Strauss Yielding Barrier Co.

References: E. L. Cousins, J. M. Wilson, T. U. Fairlie, G. T. Clark, R. F. Uniacke.

VAN SCOYOC—HARRY STEWART, of Montreal West, Que. Born at Canan Blair, Pa., U.S.A., June 27th, 1881; Educ., B.S. (C.E.) Univ. of Pennsylvania, 1907; 1899-1903 & summers 1904-05, rodman, dftsman etc., Penn. R.R.; 1906 (summer), transitman, H. C. Givin, munic. engr.; 1907-08, transitman, City of Altona; 1908-12, asst. city engr. of Altona, 1908-09, in charge of sidewalks & curb constrn., 1909-11, in charge of paving; 1911-12, in charge of storm sewer design & constrn: 1912-14, inspecting engr., Canada Cement Co. Ltd., Montreal; assisting in constrn. of concrete work throughout Canada, especially cement concrete paving. Summer 1914, in responsible charge of constrn. of concrete road at Plant No. 1, Montreal East for Canada Cement Co. Ltd., and concrete paving for Town of Aylmer, Ont.; 1914-18, chief engr., Toronto-Hamilton Highway Comm'n.; Feb. 1918 to date, consltg. engr., Toronto-Hamilton Highway Comm'n. Also consltg. engr., Service & Promotional Depts., Canada Cement Co. Ltd.

References: A. C. Tagge, W. A. McLean, J. R. W. Ambrose, A. H. Harkness, G. Hogarth, F. S. Keith, W. G. Chace.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

GUNN—CECIL HERBERT, of Winnipeg, Man. Born at Stonewall, Man., Oct. 12th, 1892; Educ., 2½ years Univ. of Man.; 1911-12, with Good Roads at MacAuley, Man., as rodman, instr'man & in charge of constrn.; 1912-13, gen. insp'r., Can. Inspection & Testing Laboratories, reinforced concrete & steel work; 1913-14 during vacations while at Univ. of Man.), in charge of Testing Laboratories; 1915-18, overseas, private, sgt., platoon comm'dr., 1 year Company Comm'dr., 1st C.M.R. Infantry; At present field engr., Manitoba Power Comm'n., Winnipeg.

References: J. M. Leamy, J. Rocchetti, W. G. Chace, C. A. Clendening, M. V. Sauer, T. H. Kirby.

REDMAN—WILLIAM BRIGHTHELM, of Toronto, Ont. Born at Toronto, July 30th, 1892; Educ., B.A.Sc. Univ. of Toronto, 1915; 1912 (4 mos.), survey work, Toronto Harbor Comm'n. & asst. res. engr., Exhibition Sea Wall, Toronto; 1913 (5 mos.), asst. on outside engr'g. staff, Canadian Copper Co., Copper Cliff, Ont.; 1914 (4 mos.), transitman & dftsman. on town site & mineral claim work; 1914-19, mil. service. Overseas Can. Engrs., Wounded 1915. Invalid to Canada. Appointed Lieut. Can. Engrs., Served in Canada until Nov. 1919; At present designing engr., Bridge Dept., C.N.R., Toronto.

References: R. O. Wynne-Roberts, C. S. G. Rogers, C. R. Young, J. L. H. Bogart, A. C. Oxley, C. S. L. Hertzberg, F. S. Rutherford, F. B. Goedike.

SCOTT—CECIL RAYMOND, of Toronto, Ont. Born at Richmond, Ont., May 25th, 1892; Educ., B.A.Sc. (C.E.), Univ. of Toronto, 1918; 1912-14, dftsman. mtce of way, T. & N. O. Rly.; 1915 (Apr.-Oct.), railway reconnaissance; 1916 (Apr.-Oct.), sr. dftsman., T. & N. O. Rly.; 1917, sr. dftsman, Kerry & Chace, and with James Loudon & Hertzberg, Toronto; 1918-20, chief dftsman. & designer with James Loudon & Hertzberg, Toronto, (afterwards the E. A. James Co. Ltd.), on industrial bldgs., waterworks & sewer systems, concrete bridges etc.; June 1920 to date, senior partner, Scott & Maddock, Toronto, Gen'l Contractors on concrete bridges, sidewalks, etc.

References: A. T. C. McMaster, S. B. Clement, E. M. Proctor. H. L. Seymour, W. R. Maher, R. S. C. Bothwell.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

BOYD—CHARLES STANLEY, of Chatham, Ont. Born at Uxbridge, Ont., Oct. 14th, 1890; Educ., B.Sc. Queen's Univ. 1917; 1914 (summer), rodman, Geol. Survey of Canada; 1916-17, Can. Engrs.; 1919 (Jan.-Mar.), rodman, International Nickle Co. (mine surveys); 1919 (Apr.-June), in charge of elect'l install'n for lawn of Uxbridge Lighting Plant; 1919 (July-Nov.), dftsman. Can. Des Moines Steel Co.; 1919-20, waterworks dfting office, Pittsburg Des Moines Steel Co.; 1920 (May-Sept.), designing office of above company; Sept. 1920 to date, dfting office, Canadian Des Moines Steel Co., Chatham, Ont.

References: E. A. Stone, T. S. Scott, J. B. Harvey, G. L. Guillet, E. L. Pettingill.

DORKEN—HERBERT WALTER, of Westmount, Que. Born at Montreal, June 24th, 1895; Educ., B.Sc. (M.E.), McGill Univ., 1916; 1913 (June-Sept.), foundry & mach. shop, Alexanderwerk, Remscheid, Germany; 1916-17, training course for salesmen & demonstrators, Norton Co., Worcester, Mass.; 1917-18, pyrometer-man, & research work with above company; 1918-19, chief gauge insp'r. on one shift at Lymburner Ltd., Montreal, also acted as efficiency engr.; 1919-20, estimator & asst. to mgr., Linde Refrigeration Co. Ltd., Montreal; July 1920 to date, special representative for Eastern Canada for Northey Co. of Canada, & Northey Co., Worcester, Mass. Acting as salesman, service man, and demonstrator in a technical manner.

References: E. Brown, C. M. McKergow, D. Bremner, A. A. Wickenden, A. R. Roberts.

EARLE—FRED GRAHAM, of Calgary, Alta. Born at Brandon, Man., Aug. 11th, 1888; Educ , 2 years civil engr'g. course, Univ. of Man. Field work in conjunction with course 1910-12; 1912-15, rodman & office dftsman, G.T.P. Rly. Waterous, Sask.; 1915-18, overseas, with P.P.C.L.I.; 1918-19, treatment under Invalid Soldier's Comm'n.; 1912-20, office & field work, mtce of way dept., G T.P. Rly., Biggar, Sask.; 1920 to date, asst. engr., C.N.R., Calgary Division.

References: J. Armstrong, L. S. Daynes, T. W. White, R. W. Ross, L. J. Devereux, W. E. Roe, C. H. Ellison, J. Forsyth.

McAULIFFE—FRANK P., of Welland, Ont. Born at Welland, Ont., Sept. 10th, 1888; Educ., B.Sc. (C.E.), Queen's Univ., 1913; 1911-12 (summers), asst. to city engr. Welland, Ont.; 1913 (May-Nov.), instr'man., boundry survey. Crows Nest Pass Coal Co.; 1913-17, instr'man, Welland Ship Canal; 1917 (Feb.-July), Foundation Co., Port (Colborne; 1917-19, Can. Navy; May 1919 to date, in charge of constrn. work, south end of Section 5, Welland Ship Canal.

References: D. T. Black, W. H. Sullivan, E. P. Johnson, F. X. Ahern, G. M. Hamilton.

MOONEY—FRANK MELBOURNE, Jr., of Montreal, Que. Born at Montreal, Nov. 4th, 1894; Educ., B.Sc. (Mining), McGill Univ., 1920; Royal School of Mines, Metallurgy, Feb. to July 1919; 1912-13 (summers), asst., Engr'g. dept., Montreal Harbor Comm'nrs; 1915 (summer), steel insp'r., Munitions Board, Dom. Govt.; 1917-19, overseas; 1920 (summer), asst., Geol. Survey of Canada; 1920 (autumn), recorder, valuation section, G. T. Arbitration; At present timber tester, Forest Products Laboratories, Montreal, Que.

References: J. B. Porter, W. McNab, F. W. Cowie, C. J. Chaplin, T. W. Harvie, A. W. K. Massey.

PARKE—CHARLES SAGER, of Cleveland, Ohio. Born at Hamilton, Ont., Feb. 24th, 1897; Educ., B.Sc. McGill Univ., 1918; 1915 & 1917 (summers), Smart Turner Machine Co., Hamilton; 1916 (summer), Canadian Westinghouse, Hamilton; 1918-19, Can. Engrs.; July 1920 to date, witj Harshaw, Fuller & Goodwin Co., Cleveland, Ohio, in charge of design and install'n of chemical apparatus in the Howard-Dennison Plant.

References: G. E. Bell, E. Brown, H. U. Hart, J. W. Tyrrell, C. M. McKergow, A. R. Roberts.

PITTS—CLARENCE MacLEOD, of Ottawa, Ont. Born at Fredericton, N.B., May 5th, 1894; Educ., B.Sc. (C.E.), McGill Univ., 1914; 1911 (summer), mtce. of way, C.P.R., 1912 (summer), leveller, D.P.W., North Sask. River; 1913 (summer), engr. on constrn., Montreal High School, for Geo. A. Fuller Co., General Contractors; 1913 (June to Dec.), insp'r. of pneumatic caissons on Montreal Examining Warehouse, for A. H. Lapierre, Arch't.; 1914 (summer), asst. supt. on Toronto Bank Bldg., for Atlas Constrn. Co.; 1914-15, in charge of foundation work, heating of repairs of office block, Fredericton, N.B., for Pitts Constrn. Co.; 1915-16, engr. on constrn. No. 1 elevator, Montreal, Harbor Comm'nrs; 1916 (Jan.-May), design office, Halifax Ocean Terminals; 1916 (May-Sept.) Royal School of Artillery, Halifax; 1916-18, asst. to chief engr., Riordon Pulp & Paper Co., Hawkesbury, Ont.; 1918-19, Lieut., 10th Halifax Seige Bty.; 1919 to date, in charge of all works of Pitts Constrn. Co. Ltd., and design & operation of the factory & compressed acetylene plant of the People's Gas Supply Co., Ottawa.

References: H. M. MacKay, G. M. Pitts, J. B. McRae, O. S. Finnie, K. M. Cameron, E. Brown, F. E. Bronson.

RICHARDSON—WILLIAM AUGUSTUS, Courtenay, B.C. Born at Victoria, B.C., Oct. 2nd, 1890; Educ., B.A.Sc., Univ. of Toronto, 1912; Reg'd. Engr. Prov. of B.C.; 1908-09 (summers), timekpr., Macdonell & O'Brien, Contractors; 1910 (summer), machine operator, bridge dept., Canada Foundry Co., Toronto; 1911 (summer), dftsman., C.N.R., Winnipeg; 1912-13, dftsman., Bridge Dept., C.N.R., Toronto; 1913-14, asst. engr. for the contractors for the masonry for bridge across Fraser River at Fort George, B.C.; On completion of masonry was employed by Canadian Bridge Co. as engr. & field office man on erection of steel for same bridge; 1914-19, overseas; Enlisted as gunner, promoted to Capt., Awarded M.C.; 1919 to date, asst. district engr., D.P W., B.C., in charge of Comox district.

References: A. E. Hodgins, P. Philip, G. H. Richardson, D. O. Lewis, J. E. Griffiths.

STRATHEARN—DAVID KARL CRAWFORD, of Morrisburg, Ont. Born at Midland, Ont., Sept. 9th, 1895; Educ., B.A.Sc., Univ. of Toronto, 1919; 1916-19 (summers), on geol. surveys in Man. & B.C.; Nov. 1919 to date, engr. with M.C. Hendry, on St. Lawrence River investigations for H.E.P.C. of Ontario.

References: M. C. Hendry, S. Bowen, C. H. Mathewson, J. J. Traill, O. B. Bourne, P. Gillespie, W. P. Gross.

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Modern Practice with Steam Superheaters and Their Fields of Use

Design, including a detailed study of types of superheater installation, application, and use; the paper concludes with comparative tables of performance with saturated and superheated steam.

H. B. Oatley, Vice-President, The Superheater Company

Read before Montreal Branch, November 4th, 1920.

Type of Superheater

It may be of interest, at the start, briefly to describe the various principles on which superheaters have been designed. Broadly speaking, there are two major divisions:—

1st. Separately fired superheaters,
2nd. Integrally built superheaters.

It is proper to point out that superheaters of either of these two divisions may be built either as tubular or cellular structures. The tubular form of construction is the best known and almost universally used, the superheater elements in the same being of tubular shape carrying steam on the inside, and absorbing heat from the products of combustion in contact with the outside.

The cellular form of superheater construction is the reverse of the one just described. The products of combustion passing through tubes with which the steam to be superheated is in contact on the outside. The general structure may be likened to that of a fire-tube boiler.

Separately Fired Superheaters

These are located apart from the boiler and its settings, in reality being a detached unit, with an independent source of heat supply. Steam from the main boiler is led to the superheater, and after being superheated goes to the engine, turbine or other apparatus where it is to be used. Separately fired superheaters are used but very little, if at all, in marine practice; have never been commercially utilized in steam locomotives, but are quite often found in industrial plants. The thermal economy obtained by separately fired superheaters is naturally less than with integrally built superheaters, as furnace and stack losses detract from the economies which are gained by the superheating of the steam.

Integrally Built Superheaters

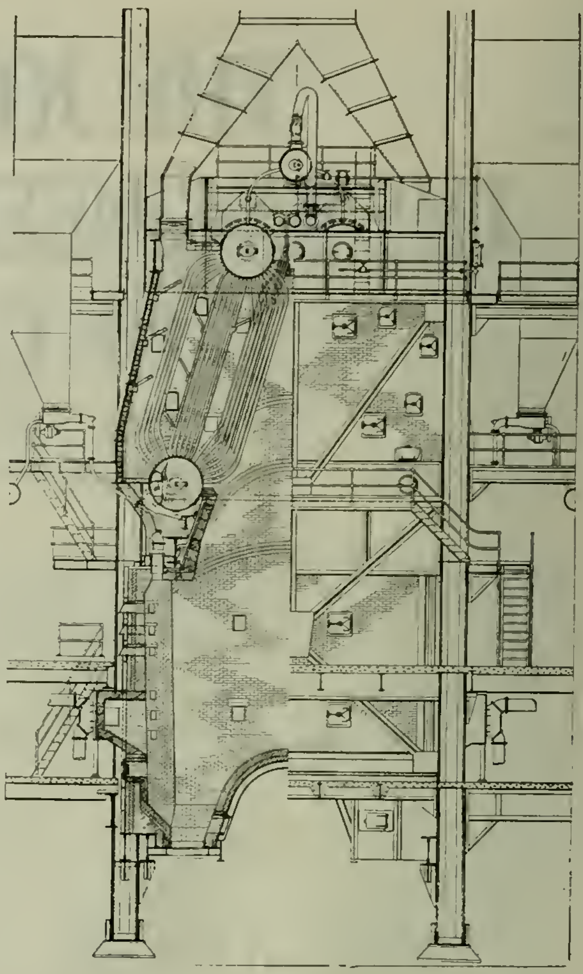
This type may be divided into three sub-classes, based upon their location with respect to the gases of combustion, i.e. whether the heat offered to the elements comes from,

1st. Waste gases,
2nd. Live gases,
3rd. Radiant heat and combustion chamber gases.

Waste-Gas Superheaters

As the name indicates, waste-gas superheaters are supplied with heat from gases which have left the evaporating surface of the boilers. Such gases are, or should be, at relatively low temperatures, and the degree to which the steam may be heated is, therefore, limited. In addition to this, the size of the superheater, even for the low degrees of superheat obtainable, becomes unnecessarily large. It is interesting to recall to mind, that in 1863 the then chief engineer of the U. S. Navy, B. F. Isherwood, in his book on "Experimental Researches in Steam Engineering" states that: "Among the disadvantages of this system is the greatly enlarged size necessary to be given to the uptake for the reception of the superheating apparatus, if the boiler calorimeter is to be retained, or the diminished draught, consequent on the lessening of the calorimeter, if no enlargement of uptake be made. Again, this method to be effective requires the products of combustion to be delivered upon the superheating apparatus at a temperature of at least 700 deg. Fahr., which can only be done by largely reducing the economic evaporation of the boiler. The superheating apparatus, is, of itself, objectionable from its cost and weight, and especially on account of the constant attention it requires from the engineer."

Waste-Gas Superheaters used have been of two general types — the bare tube and the covered tube. Theoretically, it is of advantage to extend the absorbing gas touched surface by some means of covering on the tube. Practically, this advantage is questionable, as corrugations of any kind produce favorable conditions for the collection of soot and cinders, and make difficult its complete and easy removal. No better insulation exists than soot. If this is accumulated and is not removed, superheater efficiency decreases. Furthermore, if this extended surface is in the form of shrouds, separate and different from the steam container itself, the flow of heat into the steam may be accidentally impeded. Thus, if the shroud on a superheater pipe fails to be a perfect bond with the tube, the resistance to the flow of heat is greatly increased, due to the fact that it must pass through an air space, which offers obstruction. For practical success the writer considers it more efficient to use the necessary amount of smooth surface which may be kept clean, than to corrugate the surfaces exposed to the gases.



Showing Cross Section and Side Elevation

Figure 1

Waste-gas superheaters were commonly used in the early development of superheating apparatus, and invite attention when the question of superheating is first brought to mind. It is quite natural to be interested in the extraction of heat units from waste gases, and the reclamation of such heat is to be desired. Attempting, however, to put this heat into steam which, in its saturated condition, has a temperature but little less than that of the gases, is not within the scope of superheaters. It is rather a question for feed water heaters and economizers. Admiral Dyson, U.S.N. in an article published in the Journal of the Society of Naval Engineers, says, "Superheaters, while very desirable, were omitted, as experience has demonstrated that superheaters fitted in uptakes outside the boiler lack durability, their deterioration being much more rapid than that of the boiler." Many other references could be cited to indicate that this type of superheater, except for very special conditions, fails, from a practical standpoint, in comparison with other types of superheating apparatus.

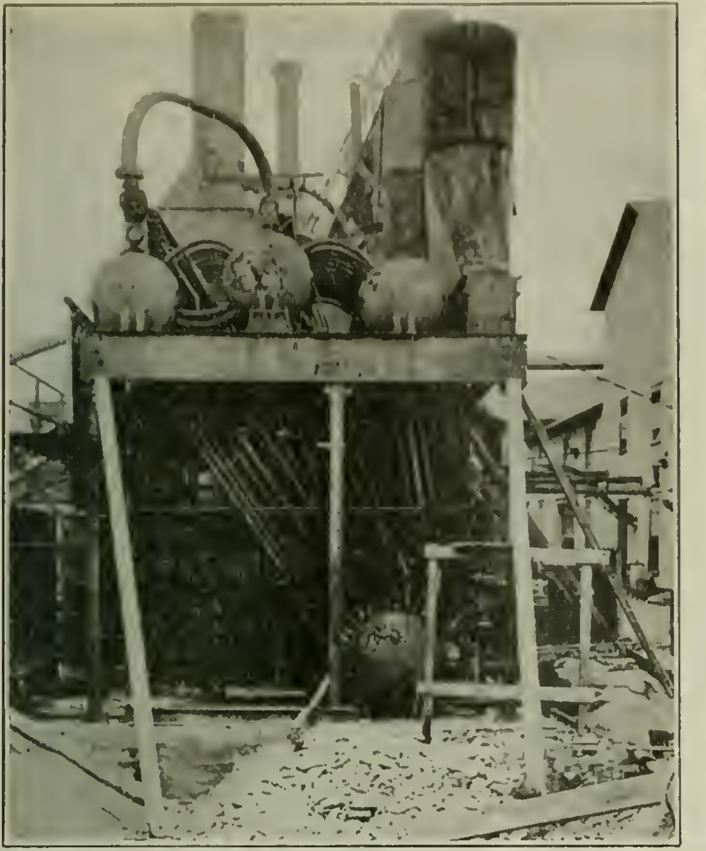


Figure 2

Three of a Battery of Four Stirling Boilers, (Brook Iron Co., Birdsboro, Pa.)

Live-Gas Superheaters

These are so located as to permit them to receive heat from gases which have not yet left the evaporating surface. In the Scotch marine and the locomotive type boilers this superheater is well and favorably known, and has been more nearly a world standard than the waste-gas, or combustion chamber (radiant heat) type of superheater. In the April 1920 issue of the London Engineering Supplement an interesting article appears, which, while having particular bearing on marine practice, covers the development and advantages of live-gas superheaters quite thoroughly.

Combustion Chamber Superheaters

There have been few practical and successful applications of this type up to the present time, although it is possible to obtain high degrees of superheat with smaller superheaters than with live-gas type of equipment, for the reason that gases at very much higher temperatures are in contact with the superheater. At the same time the metal temperature of the superheater parts becomes unduly high when life and durability are considered, and when the present available structural materials are used. It seems probable that until the requirements for steam temperatures exceed 800 deg. Fahr., the necessity for this severe superheater environment does not exist. The future, with its development in new materials, may see a wider installation and use of combustion chamber superheaters.

Design

Superheating apparatus at present available is the result of development by evolution over a long period. The fundamentals of design are not unusual, but are of extreme importance. These are:—

1st. Simplicity and Flexibility,
2nd. Accessibility and Ease of Maintenance,
3rd. Safety,
4th. Durability,
5th. Efficiency and Constancy of Performance.

That these are fundamentals has been impressed upon the writer from considerable study and analysis, extending over a long period, of many practical problems involving the use of superheaters throughout a wide range of service. Apparatus is available today that very fully embodies these fundamental requirements, and is suitable for practically all purposes where superheated steam is of value. It may not be out of place to discuss these fundamentals in more detail.

Simplicity and Flexibility

In the working out of problems with "live-gas" superheaters, which is the type most adaptable and widely used, the question of adequate combinations, for the large variety of boilers, constantly arises. The space available in many boilers, for the installation of a superheater of adequate capacity and correct characteristics, is so restricted that flexibility in the shape of the

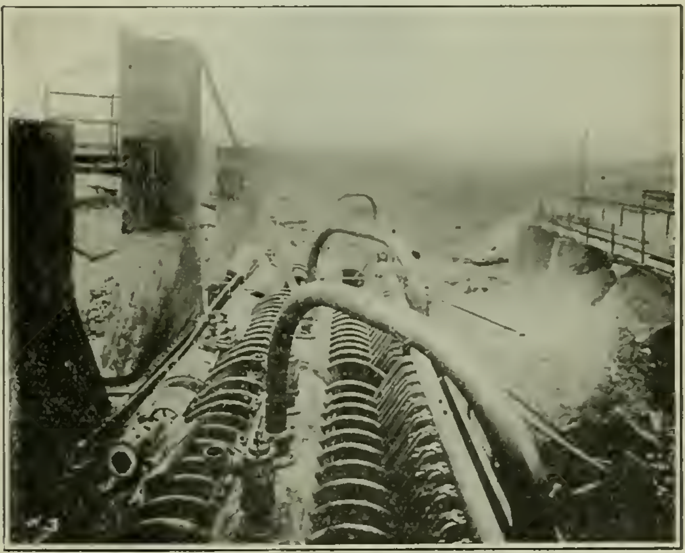


Figure 3

Top View of Boilers shown in Figure 2, showing Superheater Headers of Inside Bar Type superheater element is of practical interest. Otherwise standardization of parts, imperative if quantity production is to be obtained at permissible cost, becomes impossible. Simplicity, which is to say absence of complicated structures, is as much an aim here as in the boiler design, because superheaters form such an important link in the chain of apparatus producing energy changes in a power plant.

In the early development of superheaters too little attention was paid to the question of providing for the great and uneven expansion of superheater parts. Consideration of this requirement, combined with the desire to provide a safer structure, has led all progressive designers towards the tubular form as referred to above. With such forms of unit, unequal expansion is easily provided for.

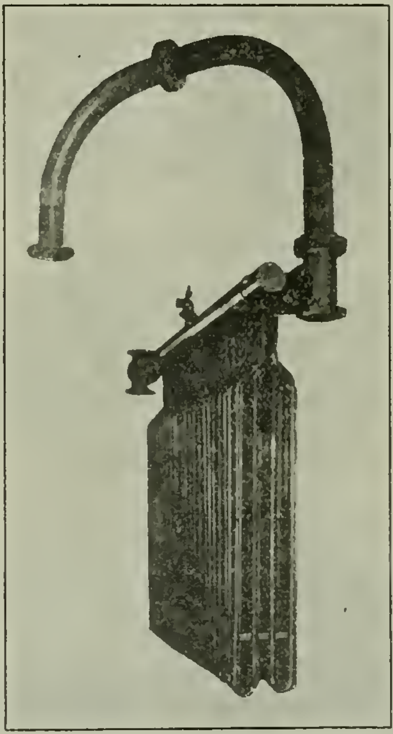


Figure 4

Superheater for Erie City Vertical Boilers

Accessibility and Ease of Maintenance

These, by reason of the importance of a superheater, should be provided for, even if some additional initial expense is involved. Because of the fact that the surfaces of a superheater are exposed to high temperature gases in large quantities, and depend for their cooling upon the flow of steam, which becomes a less ready absorbent of heat as it becomes superheated, internal stresses are occasioned in the superheater structure. This is a condition which many engineers have not sufficiently appreciated, and it is believed that no matter how cleverly a superheater may be designed as to structural flexibility, strength of joints between units and headers, etc., its service is always more severe and more apt to bring surprises than in the use of boiler design. The superheater must be so constructed, so located and so accessible that it can be repaired or replaced, and boiler operation resumed in a minimum of time and with minimum labor cost.

It is extremely important that all parts of the equipment be accessible for inspection, and all parts which, by any chance, may be subject to leakage of steam must be within convenient reach for adjustment, or replacement. Many superheaters which are unsuccessful were so located that removal of boiler and other parts was necessary in order to reach the portion of the superheater which was under suspicion.

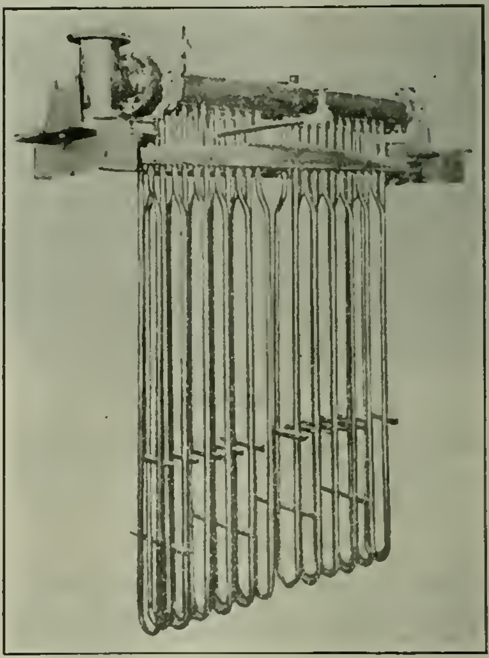


Figure 5

Superheater for Horizontal Return Tubular Boiler

The feature of removability is closely associated with the requirement for accessibility, but is intended to refer particularly to the question of the removal of any superheater unit, because of the necessity of getting at some part of the boiler, or setting. It is obvious that when such removal is necessary it should be accomplished with a minimum amount of time and labour, and without the necessity of destroying material. The writer believes that it is a poor design which necessitates the destruction of vital parts of any equipment during the process of removal, or subsequent application. For example: it is necessary to destroy material if a welded joint is broken, and in such a case it is apparent that in re-application of the repaired part, expense and time are involved in the re-welding of the broken joint. In all the locomotive and marine installations referred to later on, one of the outstanding features, from a practical standpoint, is that the conditions of removability and re-application involve a minimum of time and expense.

Safety

Practically all successful superheaters are of tubular construction, thus avoiding the dangers which are inherent in large flat surfaces, or in large cylindrical shapes subjected to the severe gas temperatures, and are of a form and construction that have a very high factor of safety.

The superheater designer is restricted in the choice of materials of construction by rules and regulations conceived by supervising engineering bodies, and enforced by Provincial and Municipal Governments, insofar as power plants and other industrial installations are concerned. Supervising bodies are also in existence in the marine and locomotive fields, and it is not uninteresting to note here how the ideas of these governing bodies in the various fields of superheater application are somewhat at variance with regard to their conception of necessary safety in superheater construction. An interesting example of this is found in the fact that in both Canada and the United States, all superheater headers in locomotives are made of high grade cast iron, which has been proven to be entirely satisfactory, and free from any element of danger. In some of the provinces of the Dominion and in some of the States where the A.S.M.E. Boiler Code is in effect, it is required that superheater headers be made of wrought or cast steel. To try and find an explanation for this peculiar circumstance would lead to a long discussion in itself. The writer, however, wishes to point out that in his opinion the danger from possible superheater explosions, or failures of any other sort, is very much smaller than in the case of drum boilers, for the reason that a relatively small amount of potential energy is stored in the superheater elements, and the superheater system is always connected to the boiler, with its immense potential energy, by means of a duct of limited flow capacity. As the requirements of superheater design practically preclude everything but wrought steel tubes for carrying the steam in superheater elements, which form the active heating surface, there is never any danger of explosions, because of the thickness which is selected to give the mechanical strength required on account of expansion stresses.

Durability

The opposition to the use of superheaters has very frequently been based on the ground that they are short lived, and that the investment in superheaters is an expensive way to obtain fuel saving. The most widely used form of superheaters is not fairly to be charged with this weakness. The best known and most extensively developed line, for which superheaters have been used, has been for steam locomotives. There are upwards of 43,000 locomotives in Canada and the United States which have, during the past twelve years, been fitted with the fire-tube type of superheater, and the large number of records which are at hand indicate convincingly that in spite of the severe service and bad water conditions which are encountered, the life of such superheater units may be considered as being upwards of seven years. In marine practice there are more than 8000 boilers, installed in more than 2000 ships, which are fitted with fire-tube superheaters delivering highly superheated steam, and the case is very exceptional where these units show signs of serious deterioration, unless involved in accidents, under ten years of operation. There are numerous instances on record where a superheater unit has not been removed, nor has there been a repair made upon it in more than six years' continuous operation.

In the stationary field short life of superheating apparatus should always be preventible through proper design, considering the more favorable operating conditions.

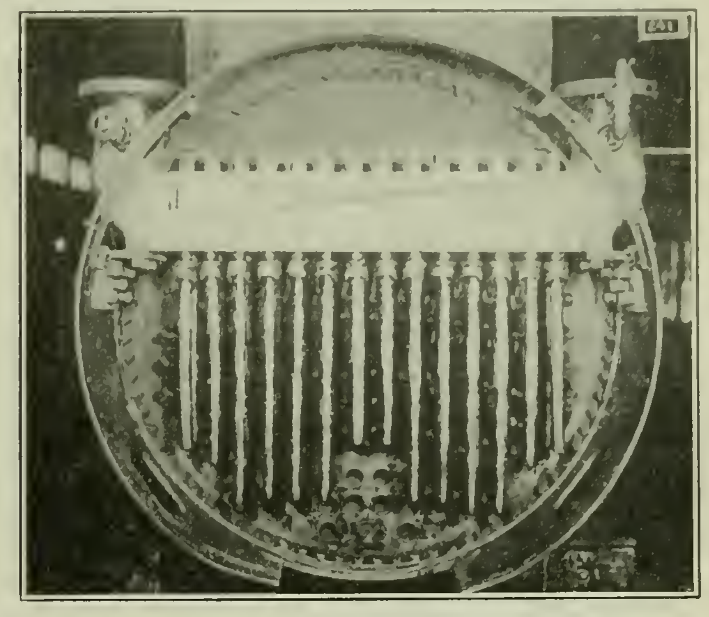


Figure 6

Front End of Steam Shovel Boiler showing Superheater

Durability depends largely upon the capacity of the metal in the superheater elements, to withstand the action of the heat. This presupposes the elements of design to be so liberally dimensioned as to withstand mechanically the large *internal* working stresses. The metal temperature of the superheater in contact with the gases of combustion establishes itself somewhere between the gas and the steam temperature, and is vitally affected by the velocities of the steam and gases. That these conditions create a variety of possibilities is evident; and the best design, from this point of view, is the one which, with all other conditions being equally favourable, has the lowest average metal temperature. There is nothing that interferes more radically with the intentions of the designer than scaling on the steam side of the elements. Scale formation, or a condition favouring it through the evaporation of water carried over from the boilers, retards the steam flow, as well as decreases the cooling action of the steam. This must be avoided, or at least minimized, if the superheater design is to fulfill the requirements of long life.

Efficiency and Constancy of Performance

A superheater design must not only be efficient when originally installed, but must be such that a minimum amount of cleaning, both inwardly and outwardly, will maintain its efficiency at the original figure throughout its life. The design of superheaters to provide high efficiencies is not as simple as might appear upon casual consideration of the question. In early design, consideration was not always given to the following points, all of which have a bearing on the efficiency and suitability of the superheating apparatus:—

(a) Steam velocities and loss of pressure through superheater units, together with accumulation of scale and deposit on interior surfaces of the units.

(b) Accumulation of soot and other insulating foreign matter on the gas touched surface of superheater units.

(c) Bulk and weight of superheater and the effect on boiler capacity due to its position in the path of the gases.

Steam Velocity

Steam velocity and loss of pressure are two important factors, their relative importance must be carefully weighed. On the one hand, the low steam velocities frequently existing in superheaters for stationary practice increase the tendency to deposit scale and insulating layers on the steam side of units, and cause a large loss in heat transmitting capacity. Excessively high steam velocities on the other hand, while eliminating the serious conditions just mentioned, are accompanied by a pressure drop through the superheater, which in many instances may be prohibitive and is often expensive. A proper limit for both pressure loss and steam velocities must be provided. Going beyond these limits must be justified by particular conditions, and a realization of the disadvantages. It is the writer's opinion that steam velocities below 1000 ft. per minute, which are frequently found in many modern installations, are unusually low, and account, in a large measure, for the short life of units, due to the accumulation of insulating material on the steam side of the units, causing them to burn out too rapidly. From long experience and consideration of the subject, it seems highly desirable to provide for steam velocities which will not fall below 3000 ft. per minute under the low rates at which the boiler may be worked, and may run to 10,000 ft. per minute when boilers and superheaters are forced to maximum ratings. It is believed that good practice will endorse such steam velocities, particularly for new plants, and quite commonly for existing plants, even if the loss in pressure should run to 10 lb., or even 15 lb., per sq. in. There is little difficulty, and very little added expense involved by an increase of 5 lb., or even 10 lb., in the working boiler pressure and such added cost as there might be would be more than repaid by the doubled, or even tripled, life of superheater units. Obviously, we cannot get something worth anything for nothing, and while it would be attractive to install a superheater that would provide no pressure loss, it is manifestly out of the question to do so and at the same time obtain the necessary superheating capacity and long life. It is a well established fact that a superheater, which is initially installed for low steam velocities, and in which an accumulation of scale takes place in the units will, in a short time, have the steam area reduced, the steam velocity and pressure loss increased, unfortunately aggravated by a decided decrease in superheating capacity, with the result that the undesired pressure loss is experienced, and the benefit of the intended amount of superheat shrinks, or even vanishes.

Soot Deposits

Accumulation of soot and dirt, as is well known, results in a serious loss in superheating capacity, which can only be overcome by soot blowers, or their equivalent. The preference of superheater designers is for a form of unit which will provide a minimum opportunity for the accumulation of soot and ashes. The surface of the pipes, as is also well known, should be smooth and the spacing of the pipes should be sufficiently great to prevent the piling up of cinders between adjacent pipes. The position of the superheater elements should be in direct gas currents where the velocity is in favor of cleanliness. Superheaters located in pockets, where the velocity of the gases approaches zero and where the deposit of entrained solid particles in the gas takes place, should be avoided. Naturally, these questions are of greater, or lesser, importance, depending on the quality and character of fuel which is used, and by the capacity at which the boilers are operated. The most widely varying and severe conditions are believed to exist in connection with the operation of locomotives, where boiler ratings of 400% are frequent, where the velocity of the gases is very high, space limitations severe and where a variety of fuels is used.

Bulk and weight of the superheater reflects the care that has been given to the questions of steam velocity and efficiency. Low steam velocities mean large steam areas requiring large diameter pipes and these, in order to get even moderate superheating capacity, mean bulk and weight. The larger the superheater, generally speaking, the greater is the effect in retarding the flow of gases, and this is reflected in the limitation of boiler capacity. This obstruction to the flow of gases, in many instances, has proved a limiting feature and prevented boiler ratings being obtained which would have been available with better superheater design.

Accessibility for Cleaning

Cleanability of both the inner and outer surfaces of superheater units must be provided for. The harmful results of not maintaining clean superheaters have already been mentioned. It is, however, a desirable provision to have units so arranged and installed that cleaning, if necessary, can be accomplished on the outside without removing the units, and on the inside after easy removal. The latter is a longer operation and can be more thoroughly and economically done away from the boiler than while the unit is in place. Many installations are so arranged that a part, or all, of a set of units may be removed, spares applied and the boiler placed in operation in a few hours. The removed unit may then be thoroughly cleaned, inspected and rendered available for application later. The superheater should have sufficient reserve capacity to "digest" reasonable amounts of moisture which will enter the superheater with various operating conditions, as for instance in ship operation, and still leave the superheaters capable of delivering the desired amount of superheat.

The most efficient superheater is the one which, all other conditions being equal, produces the desired superheat with the smallest pressure drop, and one which is so designed that its combination with the furnace and boiler, results in a maximum of combined furnace, boiler and superheater efficiency, or in other words, which results in the maximum heat absorption and in the lowest stack losses.

Application and Use

Before discussing details of construction it is desired to refer briefly to the several fields in which superheaters are used. These may be divided as follows, according to the purpose for which the steam is used.

(a) In prime movers and used expansively,
(b) In industrial process work, generally a non-expansive use.

When used with prime movers, there are three branches of engineering that utilize the economies and advantages. These are, in the order of amount of horse-power developed.

(a) Railway locomotives
(b) Stationary power plants.
(c) Marine power plants

In the railway field throughout the world highly superheated steam has become a standard. Very few locomotives have been built in any country during the past decade that have not been fitted with superheaters, the average superheat being between 200 deg. and 250 deg. Fahr., although there are many hundreds of locomotives which are developing from 300 deg. to 350 deg. of superheat.

In stationary power plant engineering the use of highly superheated steam is practically a standard. Particularly is this true in the large modern central stations. It is believed true that no engineer will consider building a power plant of this kind today without providing for the use of superheaters of large capacity.

In marine power plants this country and the United States are considerably behind other countries in the use of superheated steam. It is encouraging to find, however, that the widespread use of highly superheated steam in the British Merchant Marine, as well as in Japanese, French and Italian ships is arousing marine engineers on this side of the ocean to the necessity of reducing their fuel, and other operating costs, in order to meet the excellent performance of ships under other flags. The shipbuilding programme undertaken during the war was, of necessity, destined to accomplish results other than fuel economies, and the shortage of men and material necessitated doing many things that would not have been done under peace-time conditions. It is worth noting that the interest in, and adoption of, steam superheaters in marine practice has gone forward, since the war, at an accelerated rate.

The use of superheated steam in industrial work, besides its use in prime-movers, has been increasing at a very rapid rate during the past five or ten years. In oil industries, textile work, chemical manufacture and many other lines, new methods have been introduced, for which the use of superheated steam has been of enormous assistance, not only in the speeding up of some of these processes, but in the improvement in quality of many of the articles produced, as well as in making these processes more efficient by the reduction non-usable by-products. This enumeration is by no means complete, but will serve to emphasize theever-widening field in which superheated steam is finding favor.

Superheater Details

Before discussing general superheater installations, it is desired to describe some details which are of importance. These details apply to superheaters used in all fields of activity and represent the development in design and manufacture resulting from hundreds of installations. There may be a difference of opinion as to the relative merit of these various forms of detail, but it is believed it will be agreed that the functions which these parts have to perform are correctly stated, and that development has been along correct lines.

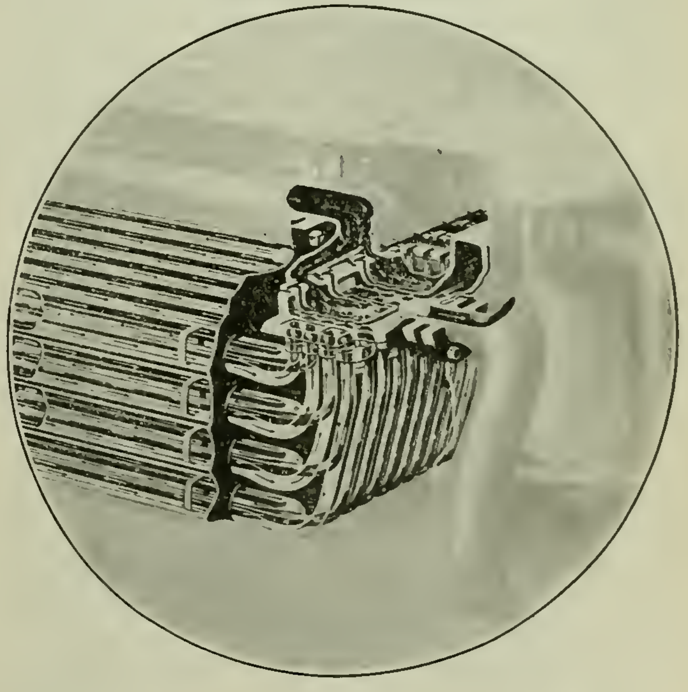


Figure 7

Arrangement of Header and Unit Connections in Type A Locomotive Equipment

Headers

Headers, sometimes termed collectors or manifolds, are generally of wrought steel, cast steel or cast iron, depending on the service and other limiting conditions. The space available for a superheater header many times requires castings, while in other installations, which afford greater space, rectangular or circular section forged headers are used.

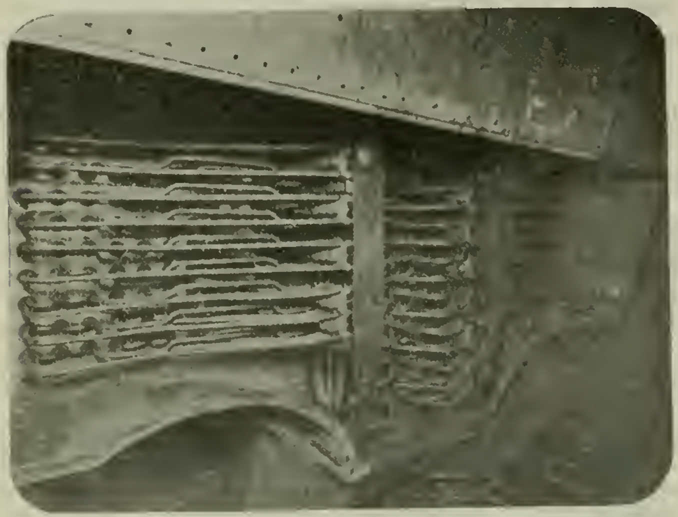


Figure 8
Marine Type of Superheater installed in a Scotch Boiler

The locomotive boiler represents the most difficult superheater installation, generally speaking, of any field. The space afforded for the header is limited and a change in the boiler design would be expensive, and sometimes practically impossible. The picture here shown represents a locomotive superheater header; material is of a high grade cast iron; the design, as it is intricate in coring, is a job which must be handled by a good foundry. An interesting feature of this design is the provision for flexibility and the elimination of stresses set up in the header during operation.

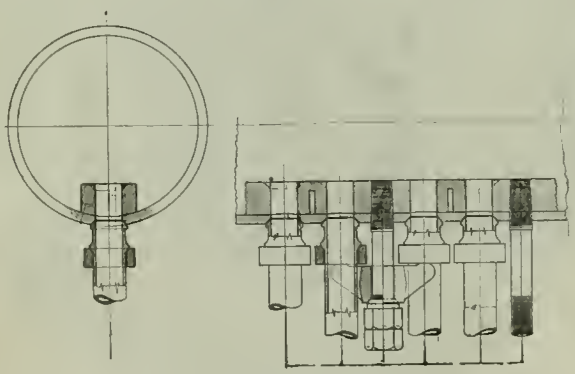


Figure 9
Stationary Superheater Header—Inside Bar

The fire-tube superheater for marine service, as fitted in more than 2,000 ships, uses a header similar to the one shown above. This is either of cast steel or high grade cast iron, depending on the particular requirement. From a service standpoint there is little, if anything, to chose between cast steel and semi-steel. Some few headers of this type have been of forged steel and have proven entirely satisfactory.

Stationary superheater headers are usually relatively long. It is, therefore, desirable to use a light form of construction, and plain lap welded or seamless steel pipe is utilized.

Connection Between Header and Element

The connection between superheater header and the superheater element is a detail that has been given a great deal of attention, and the relative merits of the various connecting means have been frequently discussed.

The figure shows four methods of joining pipes to headers.

1st. The rolled joint
2nd. The welded joint
3rd. The gasket joint
4th. The ball joint

The rolling of a tube in a plate, identical with the method of setting a boiler tube in a boiler sheet, is so well known as not to require description. The attaching of a tube to a plate or other structure by means of welding is also very well known. There are more ways of doing this than the one illustrated, and it is not contended that the picture represents a superior method. The gasket form of joint was used at first in all fire-tube superheaters, but is being very rapidly superseded by the ball joint for all uses where the diameter of the superheater pipe requires flexibility in the alignment of the joint. In marine practice where the pipes are relatively small in diameter, and have flexibility in themselves, the gasket joint is still used successfully. The ball joint connection is a very well known form, particularly to all railroad and marine men. In principle it is identical with the steam pipe joint used in every locomotive on the North American Continent. A large bulk of the superheaters used here during the past ten years have been thus fitted, and it has been practically a standard in the U. S. for a long time. The large majority of the locomotives sent to France during the World War had this form of joint, and it is very interesting to find that the French engineers, who had previously used the gasket and rolled joint, were at first sceptical, then interested, and in a short time convinced that from an

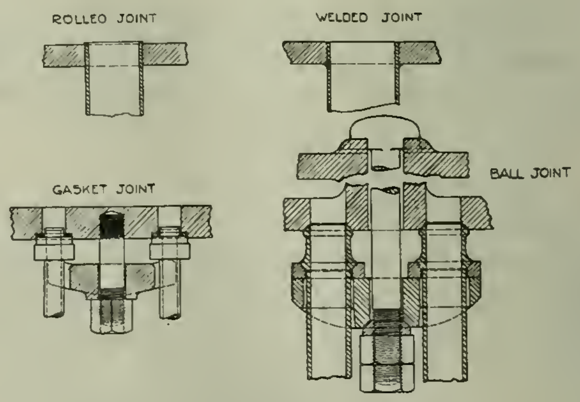


Figure 10
Rolled, Welded and Disconnectable Joints

operating and maintenance standpoint it was superior to the forms which they had used.

A comparison of the various attachment methods from the point of view of mechanical strength should not be overlooked. Strong expansion forces are at play in a superheater unit during its life, which have to be resisted by the joints and it is the writer's experience that a connection utilizing bolts of proper design is stronger than a rolled or welded joint.

The main point of difference between either the gasket or ball joint and the others described is the feature of easy removability of a unit. An additional point of advantage in joints of this character is that no other opening in the header or collector is necessary in order to apply, or remove, a unit. This same advantage may be obtained when a welded joint is used, but it cannot be obtained if a rolled joint is considered.

Types of Superheater Unit

Before going further, it should be said that the description of these units has particular reference to their use in fire-tube superheaters, although the fundamentals of unit design can be applied equally well to water-tube boilers and non-fire-tube superheaters.

As the application of a superheater to a locomotive is a particularly intricate problem and calls for highest efficiency of design, on account of the weight and space limitations, engineers have tried to devise the most efficient type of unit, and a critical analysis of what has been proposed in this connection may be illuminating to one studying the art of superheater design in general.

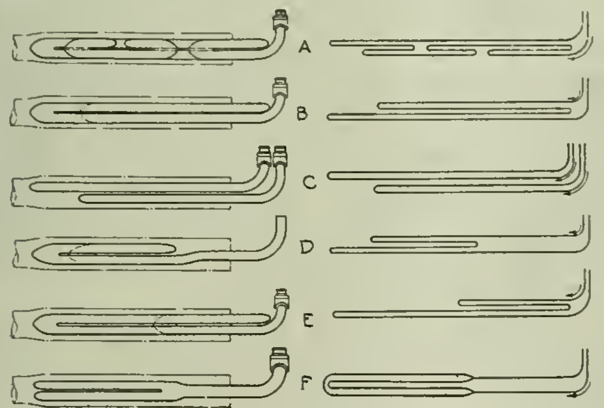


Figure 11
Types of Superheater Unit

The picture shows but a few of the forms of locomotive superheater units which have been proposed, tested and applied. All were designed to be located in enlarged boiler flues through which part of the gases of combustion pass, the balance going through smaller boiler tubes of a size similar to what is used in saturated steam locomotives. This has become a practically standard arrangement and one that has been accepted by all designers. The problem resolves itself into obtaining the maximum heat absorption, and a minimum waste-gas temperature, because obviously that only means a minimum fuel consumption for the locomotive.

Unit "A" has been termed "the ideal unit". The writer is of the opinion that it does not quite deserve this title, unless qualified by the statement that it is as close to the ideal as present practical conditions would permit. It provides, as will be noted by the arrows, for a relatively long path, with a relatively slow advance of the steam through the unit *from* the smokebox, or *low*-temperature zone, *toward* the fire-box, or *higher*-temperature zone, this being approximately a counterflow movement when taken as a whole, but during its passage toward the firebox it departs from counterflow and has, for a time, parallel flow. The design should produce a given superheating effect most efficiently, and therefore with the smallest gas flow and the smallest exit gas temperature. In a locomotive in which, on account of the intense draft many solid particles are carried over into the flues, the obstruction created by the intermediate return bends in this design would make cleaning difficult, if not impossible.

The unit marked "B" may be termed a "world standard unit", and while not theoretically perfect has so many points of practical advantage that it has well earned and justified its name. Practical considerations force one to adopt some form of unit with which provides a gas passage having a continuously uniform area, so that particles entering the flue have little chance to lodge there or to cause wear by abrasion. There should be no sudden change of gas velocity that causes either soot or cinders to separate from the carrying gas within the flue. The standard unit, while not fully embodying the theoretically most advantageous counterflow principle, is, however, free from the just named objections. Although it contains, in the forward part of the flue, some not very effective superheater heating surface, (analogous to the surface of the forward part of the smoke tubes and flues in being less effective for heat absorption on account of the relatively low gas temperature,) these units can still be proportioned with relation to the flue diameters in such a manner that they give the desired high superheating effect with an absorption efficiency of the combination of unit and flue, at least as great as, and usually greater than the absorption efficiency of the boiler tubes which are used.

Unit "C" termed "the single loop", was the design first applied in fire-tube superheaters. It is interesting to mention that C.P.R. engine 1300, in 1903, used units of this form. This style unit was used by Mr. Vaughan for a number of years afterwards in other installations which he made. One or more units of this kind may be located in a single flue, and with proper proportioning may be relied upon to deliver about 150 deg. Fahr. superheat. With modern methods of construction, which will be referred to later, this limit can possibly be raised somewhat.

It is proper to point out that the necessity for relatively high superheat and for maximum capacity did not, at that time, seem so compelling. It was not long, however, before the requirements for greater boiler and superheater capacity were more severe, the advantages of higher steam velocities were more fully appreciated, and the single loop form grew in length. Naturally it could not project into the fire-box, although experiments were made with such construction, so it was necessary to fold it up, like a two-foot rule, and it then became like forms "D" and "B".

Another interesting method of designing a superheater unit with regard to small weight rather than with regard to highest capacity or efficiency has been proposed and tested as shown in "D". Here some of the less effective superheater surface of the standard unit "B" is omitted, and while this omission of course unfavourably affects the capacity and heat absorption efficiency, as compared with type "B", there is a reduction in weight of the unit proper. This type of unit lacks the continuity of gas passage; in fact, it insures a sudden velocity change just forward of the return bend within the flue, which increases the resistance to the draft and promotes piling up of soot and cinders. If weight is a primary consideration it will be better to remove some of the more ineffective tube heating surface from the front of the boiler by setting back the front tube sheet. A few inches reduction of tube length with the incidental saving of water weight will be much more effective, and will not entail any greater sacrifice in the combined absorption efficiency.

Unit "E" is a form resembling "D", comparable with it in weight and closely approximating its practical superheating capacity. When compared only upon the basis of gas areas, and gas velocities within the flue, it has points of superiority to some of the units already mentioned. It will be observed that this unit gives less obstruction in the back half of the flue than in the forward half, and therefore there is an increased velocity of the gases in the forward portion, tending to keeping soot and cinders from depositing. It may be mentioned, in connection with this point, that from the standpoint of gas velocities the most desirable construction would be one which provided for a gas area decreasing from fire-box to smoke-box in a ratio corresponding to the decrease in specific volume of the gases. Thus a constant velocity of the gases, while passing through the flues, would be obtained and the opportunity for solid particles lodging on superheater pipes and on the bottom of the flue would be decreased.

It will be easy to analyse the merits and demerits of unit "F" from what has been said regarding the other forms.

Unit "G" is a three-pipe unit, although it can be made as a four pipe unit. A slow counterflow of the steam, and a rapid delivery of the steam after reaching the maximum gas temperature zone are provided in this form. This might be considered as being between unit "A" and unit "B", so far as this feature is concerned.

In general, the standard unit "B" represents the highest average of any form of unit thus far developed, when considered on the basis of:—

(a) Efficiency in the abstraction of heat from the gases,
(b) Thorough mixing and *uniform* superheating of the steam.
(c) Better equalization in the area of gas passage and more constant gas velocity.
(d) Maximum superheating surface.
(e) Minimum resistance to flow of gases when (c) and (d) are considered.
(f) Less opportunity for deposit of soot and cinders by maintaining relatively high gas velocity through length of flue.
(g) Cost.

Return Bends

The return bends, or connections, between parallel superheater pipes, have been by one of the various forms now shown.

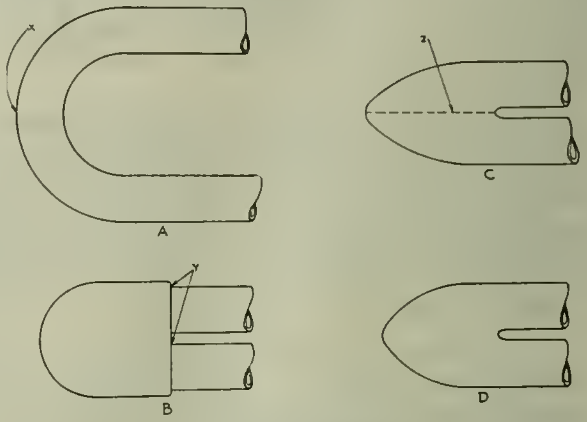


Figure 12
Types of Return Bend

"A" shows the simplest method and is merely the bending of a pipe into a hairpin loop. There is a minimum distance between pipes, below which bending is not permissible if the internal cross-section of the pipe is to be retained, and if the wall thickness at X is not to be reduced. For fire-tube superheaters, where pipes must be close together, where the surrounding gas temperature is high and the velocity of the gases produces serious abrasive conditions, a pipe bent in this way is prohibitive.

"B" shows a close coupled return bend with the pipe threaded into it. For fire-tube superheaters this, for years, was considered satisfactory, and thousands of engines have operated free from difficulties in this detail in the most severe service. With certain designs of superheaters where expansion stresses in the pipes were severe, it was found advantageous to weld the pipe and the return bend (point Y). Occasionally, due to careless manufacture, it was found that pipes were inserted in the return bend, without threading, the welding then providing the only strength against failure.

"C" shows the welded type of return bend, which has been used considerably in recent years. The term "welded", as here used refers to either the acetylene, or electric, process. Considerable experiment showed that for fire-tube superheaters working under high duty conditions, the use of these welding methods was only an invitation to possible failure. In the last few years strenuous efforts have been made, by all manufacturers of fire-tube superheaters, to get away from these methods of bending.

"D" shows the contour of a forged return bend in which no electric, or acetylene, welding is used. On the contrary, the pipes are handled, from start to finish, by machine forging methods, the bonding being done in the ordinary way, without the addition of extraneous material, which, with either electric or acetylene welding, would have a different chemical, as well as a different physical, characteristic. The forged return bend is made out of the pipe itself, and is not made as a separate piece jointed to the pipe. This point is emphasized as return bends *have been made* in which a forged end is butt welded to the pipe itself, and this butt welding would, of necessity, militate against the strength and durability of the structure.

Forging Return Bends

The photograph illustrates the various steps in the forging and will make clear the interesting features and succession of operations which result in affording as nearly a perfect and ideal structure as can be expected with the present known materials and machine processes. This form of return bend is being used both in Canada and in the United States, as well as in other countries.

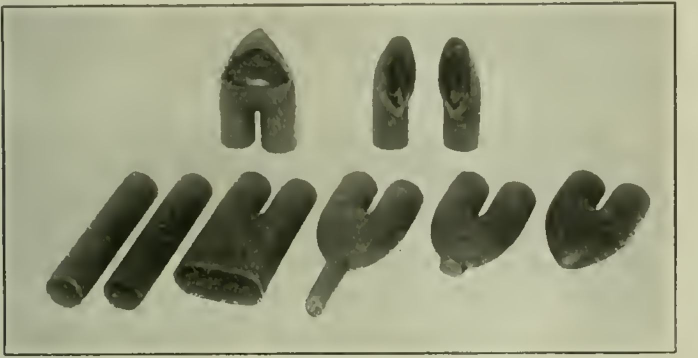


Figure 13

Steps in Process of Forging Return Bends

With the increasing size of locomotive power, increasing degrees of superheat and with restrictions of a practical nature which prevented further increase in boiler diameters, it is more necessary than ever before to utilize every possible square inch of gas area between fire-box and smoke-box. The limitation in boiler capacity, speaking now of fire-tube boilers and their use on locomotives, is in the total cross sectional gas area. The forged, and even the welded type of return bend occupies less of the gas area in the flue than the cast steel return bend which was threaded to the pipe. It is difficult, if not impossible, to increase degrees of superheat and increase boiler capacity to any marked extent, if a bulky form of return bend is to be used, and with the higher rates of boiler operation and the higher degrees of superheat demanded, the minimum obstruction to the flow of gases is compulsory.

Conclusions

Those who have endeavored to reconcile all the various general requirements will have found that the problems of superheater engineering are by no means simple, and while related primarily to boiler problems they extend also to the working of prime movers. Their proper solution is of such vital influence upon the total plant economy that they have properly become the province of specialists. The writer wishes to impress these conclusions upon all those who look to superheat as a factor of economy in steam plant design, operation and maintenance.

Results of Superheating

Some of the illustrations may be of value in making clearer the economic results of decreased fuel consumption, as well as the increased power from the use of superheated steam.

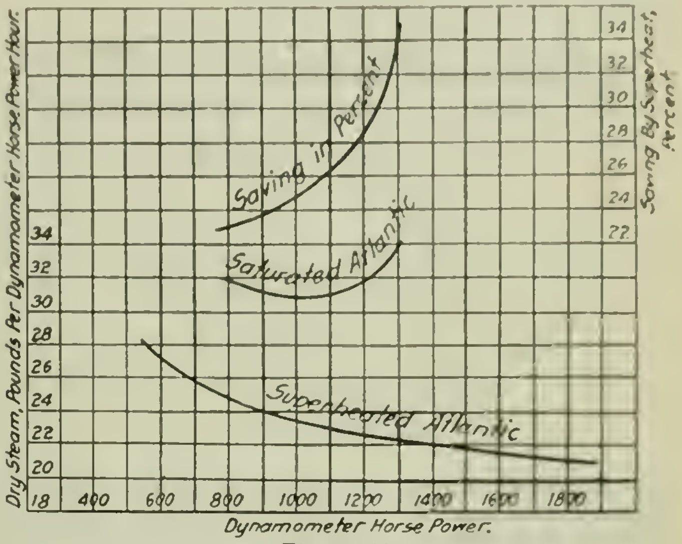


Figure 14

This shows the dry coal used per dynamometer horsepower at various engine outputs, the curves were obtained from an Atlantic type passenger engine. It will be noted that the saturated steam locomotive increased in its fuel consumption very rapidly as the horsepower increased, and that the maximum output of this engine was about 1320 dynamometer horsepower. The same engine, with a superheater giving 200° of superheat, shows an improved fuel performance at all ratings, and enabled the locomotive to develop a maximum of about 1860 h.p. The upper curve shows the saving in percent over the power range covered by the saturated engine. This saving varied from 12% at 760 h.p. to 40% at 1320 p.h.

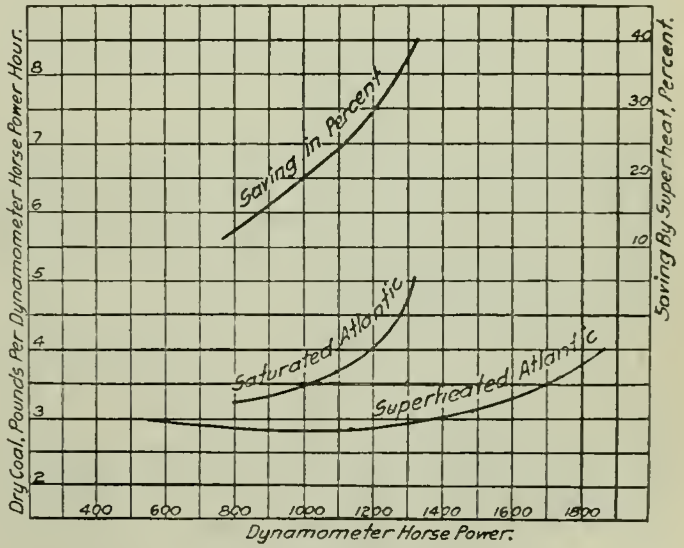


Figure 15

This shows the steam rate of this same locomotive. It is worthy of note that the specific steam consumption was considerably better as the rating increased. It is a confirmation of the fact that a saturated steam plant whether it be on a locomotive, in a ship, or for stationary use, becomes more wasteful as it is forced, both on account of the increased moisture in the steam, and the increased temperature of the discharged gases.

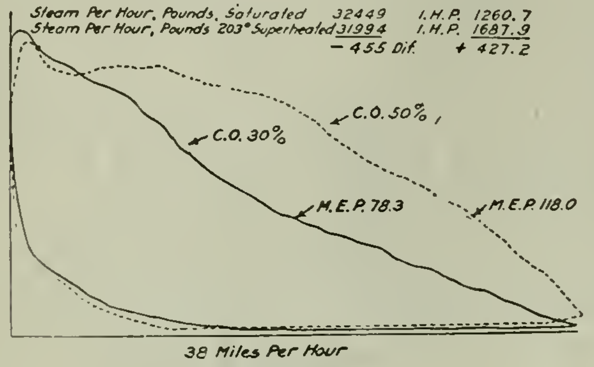


Figure 16

Indicator cards from two locomotives, one using saturated steam and the other using superheated steam, both operating at approximately the same water rate. It should be observed that the superheater engine was able to use a 50% cutoff, while the steaming capacity of the boiler with saturated steam necessitated a 30% cutoff. The increase in horsepower was 427.2, or 33.8%, the water rate being approximately 32,000 lb. per hour for both engines.

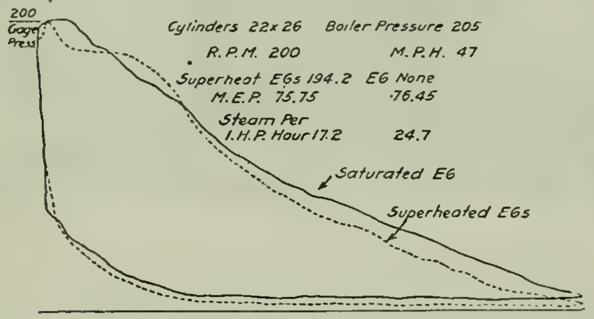


Figure 17

A companion picture to the proceding, but showing cards with practically the same mean effective pressure, and hence the same horsepower, inasmuch as the r.p.m's were the same. Attention is invited to the fact that the superheated steam locomotive have a horsepower for 17.2 lb. of steam, while the saturated locomotive consumed 24.7 lb., an economy of 30.4%.

Fuel performances based on hundred deadweight ton miles, for a large number of vessels, some using saturated steam, some using moderately, and some highly superheated steam, are here shown. The fuel consumption is given, graphically, by the heavy horizontal line. The short lines ranging up to three pounds, show performance of the highly superheated steam vessels. Some of these are reciprocating engines, some geared turbines and some turbo-electric drive. The longest lines are those from vessels using saturated steam and are convincing evidence of the economies resulting from using superheated steam.

Comparative Costs—for three Japanese Ships

	Ship A 200° S.H.	Ship B 100° S.H.	Ship C Saturated
Distance run (miles)	22,191	22,080	22,240
Coal per day (tons)	37.8	45.3	46.1
Coal per 100 miles (tons)	16.0	17.9	18.7
Coal per 100 miles (relative)	85.5	95.7	100.0
Cost of coal per 100 miles in dollars	186.38	190.40	234.29
Cost of coal per 100 miles (relative)	79.5	81.3	100.0
Mean working displacement	13,500	13,000	13,100
Coal per 100 displacement ton miles, lbs.	2.62	3.03	3.19
Coal per 100 displacement ton miles, (relative)	80	95	100

These ships are identical in hull sizes, and run over the same route at approximately the same season of the year.

The table above gives a tabulation taken from the actual operating performance sheet of a large fleet of foreign vessels, three ships being selected which were identical in all respects, except for the fact that one used saturated steam, one used moderately superheated steam and the third used 200° Fahr. of superheat. Attention is invited to the relative fuel performances, which show a 20% saving for the highly superheated steam vessel, and 5% economy for the 100° superheated ship. The saving may be noted, in passing, as four times as great for 200° of superheat as for 100°.

These Tests Were Made Under Actual Operating Conditions

Machine shop only under constant load conditions at night.
Tests were made about two weeks apart with flues in approximately the same condition

	Duration of Tests-4 hours each			
	Saturated steam	Superheated steam	% Increase	% Decrease se
Total Coal Consumed-Pounds	9316	6827		26.7
Steam Consumption-lbs. of water	57500	46000		20.0
Av. Steam Pres. of Boilers	118.0	115.0		2.5
Aver. Load on Corliss Engine-I.H P.	43.0	43.6	1.4	
Aver. Load on Woodmill Engine-I.H.P.	43.2	42.8		0.9
Aver. Load on electric Generator-K.W.	56.7	56.8	0.2	
Revolutions of Air Compressor, Total	26590	26630	0.1	
Boiler H.P. Developed	386	336		12.9
Percent Rated Capacity Developed	107.0	93.3		—
Temp. Feed Water-°F	212	207		2.4
Heat Value-1 lb. Coal-B.T.U.	13510	13190		2.4
Degrees Superheat-Main Header	—	163	—	—

A Logical Scheme for Determining the Concrete Making Value of Available Aggregates and its Practical Application to the Production of Concretes of Pre-determined Quality in the Field

Investigation of current theories of proportioning concrete, analysis of the factors to be considered; the proposed scheme in theory, results obtained in application at Saskatoon.

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Read before Calgary Branch, The Engineering Institute of Canada, March 18th, 1921.

1. General Discussion of the Problem

The efficient and economical use of available concrete aggregates is a problem which confronts all engineers and contractors who are concerned with the production of concrete. With few exceptions the actual quality of concrete produced is seldom known owing to the limited amount of attention which is paid to the testing of field concrete. In general, concreting practice is based upon experience which has in previous work apparently resulted in a safe structure. While concretes of definite strength values are assumed and specified in design, it is seldom that precautions are taken to insure that the concrete as made and placed attains the assumed design strength. During the past few years there has been some improvement in this respect. In some cities, on some concrete road work, and on some works involving the use of large quantities of concrete, efficient inspection and testing has not only resulted in improvement of quality but in determining the actual quality of concrete as placed.

The Danger of Uniform Mix

However, definite strength values are available for only a very small percentage of concrete produced, and except where a proper system of inspection and testing has been adopted, it is very probable that little of the product ever approaches the strength values assumed in design. Careful supervision at the mixer to insure the exact proportions of materials specified is not sufficient, since too often the mixtures are arbitrarily specified with no knowledge of the true strengths which will result from the use of any stated proportions of the given materials. From Alaska to Florida it is commonly assumed in design that a 1—2—4 proportion will result in a concrete having a compressive strength of 2000 pounds per square inch at 28 days, in spite of the fact that no consistency or flowability is specified and that aggregates having the widest possible variation in physical characteristics may be employed. Either of these two important factors may alone account for strength variations of 50% or more below the assumed 2000 pounds value. In many localities the best available aggregates employed in a 1—2—4 proportion, cannot possibly furnish higher strength values than 50 to 60% of that assumed in design even when flowability is held to minimum. An excess of mixing water will still further lower strength, yet specifications continue to state that a 1—2—4 proportion shall be employed in the work and that 2000 pounds shall be assumed in design.

In spite of the large amount of experimental work carried on during the past twenty years it can safely be said that the problem today of combining cement with aggregates to produce concrete of definite quality is farther from solution than is the design of reinforced concrete itself. Any procedure in practice which would permit reinforced concrete members to be built with only 50% of the steel required by standard design would be classed as criminal and the structure condemned, yet structures are being built in which the concrete has only 25% to 50% of the strength on which design is based.

Responsibility for the existence of such a condition must be borne by those who fail to check up the quality of concrete as placed in the work. However it is difficult to place all of the blame in this manner since the engineer must depend to a great extent upon the recommendations of investigators who have proposed various methods of proportioning concretes and have furnished more or less definite instructions for the procedure to be employed in practice. Even though the engineer's compliance with the rules of proportioning is only partial, and insufficient to attain the desired standard, a certain feeling of security and safety results. It is seldom that a field engineer has facilities for checking up proportioning theories on the job and he can do little more than accept the one which seems most accurate or can be most easily applied. So long as actual failures do not occur the results obtained are generally considered to be a verification of the soundness of the theory.

Proportioning Theories

Of the various proportioning theories which have received greatest prominence and which have been adopted wholly or in part by many field engineers, the following are of greatest interest.

(a). Fuller's Theory of Maximum Density

Based upon the results of a large number of tests and application to construction work a practical gradation curve called the curve of maximum density was obtained. Fine and coarse aggregate are so graded that when combined with the cement the granular analysis curve closely resembles this curve of maximum density. It is claimed that concretes of maximum density will have maximum strength, so that the aggregates are screened into as many sizes as practicable and recombined to fit the maximum density curve. This theory of proportioning has been well known to engineers for a number of years and has received considerable prominence in text books relating to concrete.

(b). Water-Cement Ratio Theory of Proportioning

This theory, as advocated by the Lewis Institute Laboratory of the Portland Cement Association, states that for aggregates of good quality which are not too coarse for the quantity of cement, the strengths of concretes so produced are entirely dependent upon the ratio of the volume of mixing water to the volume of cement in the mix. For aggregates from the same source and of the same fineness modulus, containing equal quantities of cement, it is claimed that the same quantities of mixing water will be required for each to result in equal consistencies and concretes so prepared will have the same compressive strength. Strength is entirely dependent upon water-cement ratio and a water formula is supplied which is based upon the water requirements of the neat cement, the relative quantity of aggregate, its fineness modulus and its absorption.

(c). The Surface Area Theory of Proportioning

This theory, first advocated by L. N. Edwards and claimed to have been successfully applied on the work of the Ontario Hydro-Electric Power Commission, states that compressive strength of concrete will be proportional to the ratio of cement content to surface area of aggregate. That is, if a number of aggregates of the same type, varying widely in gradation and consequently having different surface areas, are made into concretes having a constant cement-surface area relation, equal strengths will result. Strength is said to decrease as the aggregate area per unit of cement increases, so that more cement is required in concretes made of finer sands or containing a larger relative quantity of sand to insure equal strengths. A water formula advocated when the theory was first introduced, resulted in equal water cement ratios for any such group of aggregates, and it was claimed would result in equal consistencies. It should be noted that the surface area water formula aims to provide equal consistencies for aggregate gradations varying widely in surface area and in fineness modulus, while that proposed with the water-cement ratio theory states that equal consistencies are obtained so long as the aggregates have the same fineness modulus, and the same cement content. Both conclude that concretes having equal water-cement ratios will have the same compressive strength.

The above theories and their application to the selection of the best aggregate gradings for concrete will be later referred to in detail.

Practical Considerations

Let us consider the practical conditions which must be kept in mind and provided for by the engineer or contractor in proportioning concrete. The problem in every case is so to use the available aggregates that the concrete strengths assumed in design will be attained. Whatever the materials employed or the conditions under which the work is carried on, the sole object is to produce concrete of this specified strength at a minimum of expense. There are three important and variable factors which must be taken into account.

(a). *Cement* — Concrete strength is affected by both *quality* and *quantity* of cement used. Any possible reduction in quantity without lowering concrete strength will reduce cost.

(b). *Aggregate* — One or more aggregates may be available for use. Perhaps better quality aggregates may be brought to the work from a distance at an increased cost, or the aggregates near at hand may be improved by regrading, washing, etc., at an increased cost. Generally the expense of improving aggregate or of importing aggregate must be balanced against the cost of additional cement which would be required for use with the unimproved aggregate.

(c). *Flowability or Consistency of Concrete* — On any work it is an absolute necessity that a workable consistency or flowability which may be called the minimum usable flowability be attained. The use of a drier mixture would increase placing cost, slow the progress of the work and result in a honey-combed mass. Flowability with given materials can only be increased by the use of a larger quantity of mixing water, which in turn reduces compressive strength and requires increase in cement content to maintain the specified strength. The minimum flowability required is governed by practical considerations on the job and is a primary factor which cannot be neglected.

It may be stated that strength and flowability are fixed factors while cement and aggregate are the variables. The effect of aggregate gradation on strength may not be great within rather wide limits for aggregate from the same source of supply, while cement, the only strength furnishing element in the mass, can be varied widely as to quantity to result in any desired strength, but only at increased expense. For economy it is essential that the quantity of cement be kept at a minimum.

With respect to occurrence and availability of aggregate each locality has its own individual problem. One or more sources of supply which will furnish aggregates similar or differing greatly in physical characteristics may be available. Selection of material from any one source must be based upon cost as well as physical characteristics. In general with these factors equal, no aggregate should be eliminated from consideration except by proper strength tests.

The foregoing factors are met with by the field engineer in producing concrete and any scheme of proportioning devised in the laboratory must give proper consideration to them. Any proposed theory of proportioning must be directly applicable to field conditions. The machinery and procedure employed in concreting practice have been developed by years of experience and any scheme of proportioning, worked out in the laboratory, which radically changes what is now good practice in the field must furnish results greater in value than the added cost of the changes required.

It should be emphasized that the actual value of any proportioning scheme advocated can best be determined in the laboratory where all factors, such as proportions and quantities of materials, can be carefully measured and controlled. Field tests may give the same indications of value, but with wider variations in results owing to the difficulty in the field of accurately measuring and controlling quantities, curing conditions, etc. Results obtained in the laboratory can be reproduced except with wider variations in the field, providing the laboratory has given proper consideration to the difficulties met with in the field. Conversely, the apparent truth of a theory as established in the field may or may not be verified under the more accurate control methods of the laboratory.

2. The Proposed Scheme

The scheme for determining the concrete making value of aggregates and predetermining quantities of materials required for field use as outlined in the following, involves no "discoveries" or establishment of "fundamental laws". Many features in the scheme will be recognized by engineers and contractors who have been successful in producing good concrete, other features, especially those involving the measurement of consistency are new. It is primarily based upon laboratory tests which give full and proper consideration to conditions and limitations which effect the process of concreting in the field. It involves no re-working of aggregate beyond the separation of pit run material into sand and gravel which is now considered good and necessary practice on any work of importance. There are three main steps or divisions involved in the proposed scheme:–

Step No. 1. Selection of the "Desirable" Fine-Coarse Aggregate Gradation

Divide the material from any source of supply on the No. 4 or the ¼″ screen. Prepare concretes having the same cement contents and flowabilities, varying the relative quantities of sand and gravel in the separate batches. Four or five fine-coarse aggregate combinations should be employed such as 3–7, 4–6, 5–5, etc. If material is available from more than one source, similar combinations should be used for each. All tests should be fully comparable as to cement and cement content, flowability, and other conditions. The same tests should be repeated if possible with other cement contents and flowabilities. In general two cement contents and two flowabilities should be sufficient to establish the best fine-coarse aggregate gradation and also determine the best source of supply. Freedom from segregation in the wetter flowabilities as well as compressive strength should be the basis of selection. Weights per cubic foot of dry mixed aggregate should be obtained for each combination. Considering material from any one source, the dry aggregate combination having the greatest unit weight will generally be found to produce the strongest concrete. For some aggregates the maximum weight combination may be harsh working and show a tendency to segregate in the wetter mixtures, due to a deficiency of fine material, in which case the one next higher in sand content should be chosen. That the "desirable" fine-coarse aggregate relation is that one having the greatest unit weight is not here stated as a general rule but it has been found true in the writer's experience in working with aggregates of widely different characteristics.

It should be noted that this weight is that of the fine plus the coarse aggregate in the *dry* state and *does not* include the cement or the water. Such a combination in a concrete will have a *lower* density than a combination containing less fine material.

Step No. 2. Proportion — Strength Relations for "Desirable" Aggregates in Concretes of Different Cement Contents and Flowabilities

In step No. 1 the desirable fine-coarse aggregate ratio was determined. Under Step No. 2 concretes are prepared with varying cement contents which will give concrete strengths throughout the ranges employed in practice for wet and dry consistencies. Arrange these results in diagrammatic form, showing the relations between compressive strengths, cement contents per cubic yard of concrete, volumes of cement and fine and coarse aggregate. The strength values found for the above factors are those resulting under the accurate laboratory control employed and they will probably be somewhat higher as well as of smaller variation than can be obtained in the field. Knowing in advance of the beginning of work the specified strength and the probable minimum consistency which can be employed an estimate can be made of the quantity of cement, the fine and the coarse aggregate which will be required per yard of concrete to attain the concrete strength specified.

This diagram will show at a glance the quantities of materials required to result in a concrete of any definite quality for aggregates from this particular source. Until these values can be verified by the results of field tests, as outlined under Step No. 3, proper allowance must be made for possible variations.

Step No. 3. Verification in Practice Under Field Conditions

Owing to variation in brand and quality of cement, inaccuracies in measuring aggregate volumes, differences in flowability from batch to batch, and variation in curing conditions it is not to be expected that concretes produced on the job will be as uniform in quality as those of the laboratory from which the working diagram is originally devised. Therefore, it is likely that a systematic method of sampling and testing of field concrete under uniform inspection conditions will indicate corrections and modifications which should be made to the original diagram. After a few applications to field work a revised diagram may be prepared which will insure production in the field of concretes equal or slightly superior to those assumed in advance. With similar aggregates it is probable that greatest variations from the laboratory values can be accounted for by variation in cement quality, a change brought about by storage. In connection with these tests, a standardized compression test for cement can be employed to give direct comparison between the cement which is to be used on a particular job and the quality of cement used in tests from which the diagram is derived.

3. Application of the Scheme to Aggregates Available in the Vicinity of Saskatoon, Sask.

The above described scheme was worked out in detail using the aggregates available in the vicinity of Saskatoon. These aggregates are usually pit run gravels obtained from different pits in the vicinity. The gravel from the different pits is quite similar in grading and physical characteristics, being of silicious and limestone composition, with many of the larger particles covered with hard, rough and well bonded limestone concretions. Generally 90 to 95% will pass the ¾" screen and 60 to 80%, the No. 4 screen. It is common practice in the city to use pit run aggregate as received for ordinary work but in some larger work screened aggregate has been employed. Laboratory tests indicate no appreciable beneficial effects due to washing. One of the main sources of supply is a gravel pit near Warman, Sask., from which shipment is made by rail a distance of about fifteen miles. The aggregate used in the following tests was obtained from this source.

In the laboratory tests a bag of 87 pounds of cement was considered as a cubic foot and loose weights of aggregates is an air dry condition were used in proportioning by volume. All proportions were converted to a weight basis for accuracy. Water quantities were weighed and unit weights of concrete were determined in all cases for calculation of density and cement content per cubic yard of concrete.

Flowability

Consistency or flowability was measured by means of the "flow table", an apparatus devised by the writer. This table as shown in Fig. 1 consists of a metal covered table top which can be raised vertically and dropped through a fixed distance, ordinarily a distance of ½ inch. A mass of wet concrete is molded on the metal top in a sheet metal mold having the shape of a hollow frustrum of a cone 6" high with upper and lower diameters of 6" and 12", respectively. After molding, the metal form is withdrawn and the table top raised and dropped 15 times by means of a cam. The flowability figure is obtained by dividing the new diameter of the mass by 12 and multiplying by 100. Tests have shown that by this method all ranges of consistencies used in practice from the wettest to the driest can be accurately measured. For given materials of the same gradation, "flow" is proportional to the amount of mixing water in the concrete and is also proportional to velocity of flow in a steel chute. The slight decrease in flow after mixing water is added due to absorption of water by the aggregate can be accurately measured. For this reason, when making comparative tests, it is necessary to measure flow at some definite period after the addition of mixing water. A more complete description of the flow table and its operation will be found in the June 26, 1920 issue of "Canadian Engineer".

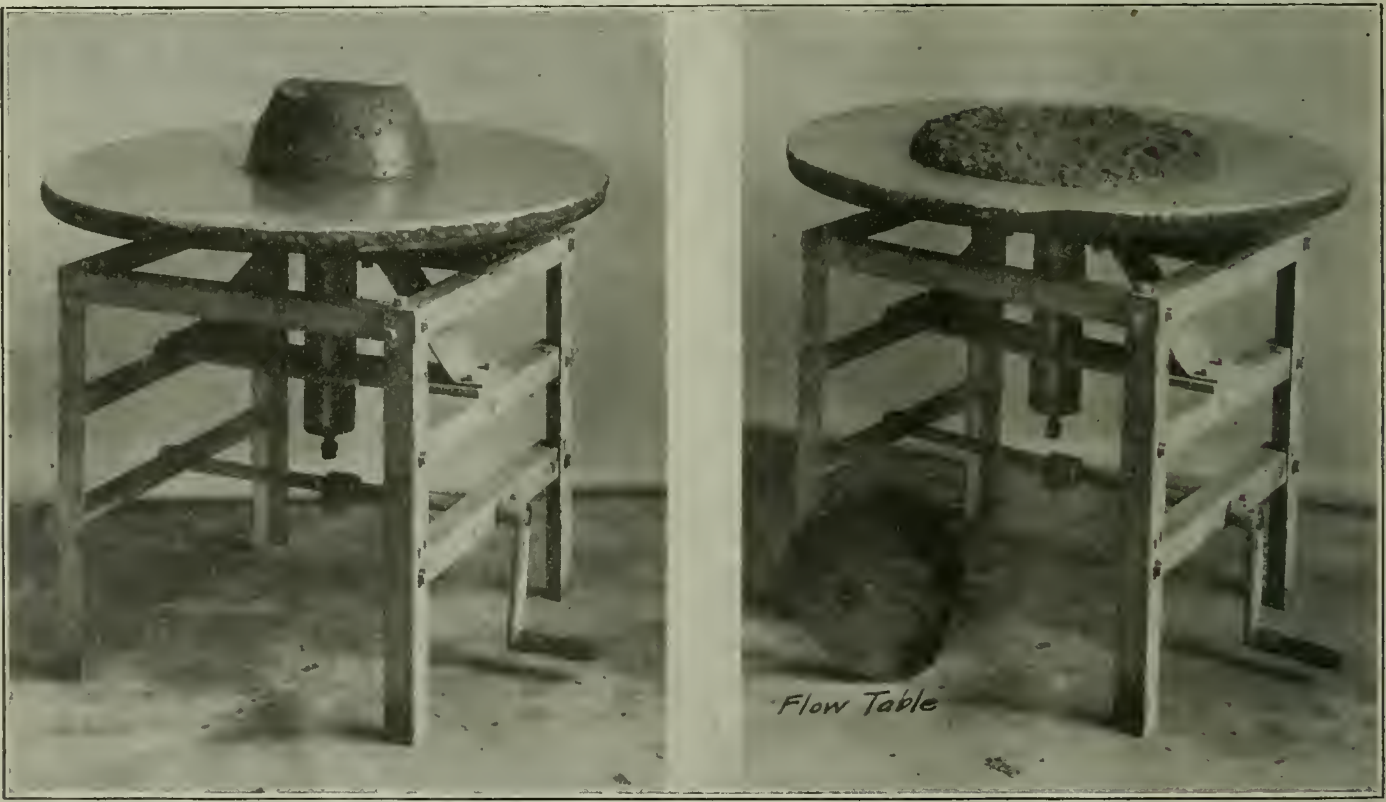

Figure 1.
Flow table used for measuring consistency or flowability of concrete.

Grading Saskatoon Aggregates

In accordance with Step No. 1 of the scheme previously outlined, the following procedure was observed in determining the concrete making value of Saskatoon aggregates.

Pit run material as received was separated into sand and gravel on the No. 4 screen. Various combinations of sand and gravel were then made and the unit packed and loose weights of each determined. The relative quantities of sand and gravel in each were as follows: .35-.65; .45-.55; .55-.45; .65-.35; .75-.25. Previous experience had indicated that any smaller proportion of sand than .35 would prove harsh and unworkable, with considerable segregation as compared with "oversanded" combinations. The .75-.25 combination is very similar to the grading of the original pit run material. It should be noted that the .35-.65 combination is the relation which would result in case the usual 1—2—4 or 1—3—6 concrete were specified.

Concretes having equal cement contents and flowabilities were then prepared with each combination. The fineness modulus, the water-cement ratio, the surface area per gram of cement and the density were computed for each concrete.

In Fig. 2 are shown the gradings of sand and gravel before re-combination, the weights per cubic foot for each combination both loose and packed and the 28 day compressive strengths found for each concrete. As was found in previous tests the .55-.45 combination produced the strongest concrete, only slightly higher than the other four combinations, among which there is little choice. For aggregate from this particular source there may be wide variation in the sand content without appreciable effect on strength. The excess strength in favour of the .55-.45 combination is only slightly greater than is the normal variation which would be expected among different batches of the same combination. There is some similarity between the curves for unit weight of dry aggregate and for strength.

Review of Current Theories

These results permit a detailed review of the previously mentioned theories of proportioning. Had either one, or all of these theories been applied to the problem of selecting the most suitable sand-gravel gradation, would they have indicated a preference for any one combination and would they have selected the same combination which was indicated by the results of strength tests?

In Fig. 3 are shown the relations between compressive strength, based upon tests, and values computed for fineness modulus, surface area, density and water cement ratio.

Application of the Water-Cement Ratio Theory of Proportioning

It is noted that fineness modulus of the aggregate decreases as the percentage of sand in the batch increases. By this theory the concrete having the lower modulus will require more water to attain the same consistency, which results in increasing w-c, which in turn should lower compressive strength. The water-cement ratio theory would select the .35-.65 or possibly the .45-.55 combination as most suitable and would predict lower strengths for the higher sanded concretes. Test results show little choice among these combinations as to strength and indicate that the use of the higher sanded batches will not result in lowering compressive strength and they have in their favour no tendency to segregate as is found for the lower sanded combinations. This freedom from segregation is of the greatest practical importance to the field engineer.

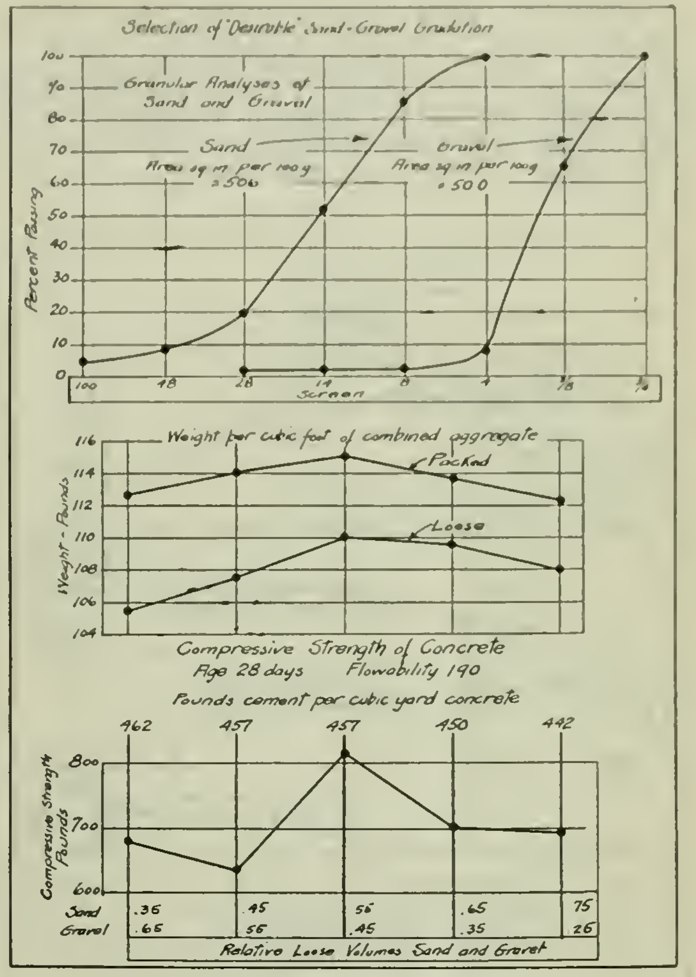

Figure 2.

Granular analyses of sand and gravel from Warman Pit, Saskatoon, as used in tests, weights per cubic foot of different relative proportions of sand and gravel, and strengths of concrete produced with each. Note that these concretes are fully comparable since all concretes have the same flowability and same cement content per cubic yard of concrete. As a result of these tests the 55-45 sand-gravel ratio was chosen as "most desirable".

Application of the Surface Area Theory

In Fig. 3 it is seen that surface area in square inches per gram of cement varied from 11 to 17.5, more than 50% without reduction in strength. These results verify conclusions previously drawn from other test data that surface area of aggregate may be increased as much as 50 to 100% without strength reduction.

These test results demonstrate that slight changes, especially increases in area of aggregate, during the progress of the work do not require any change in cement content to maintain strength. The "surface area" theory would select the .35–.65 aggregate combination while tests indicate the higher sanded combinations to be of equal quality as to strength and to have less tendency to segregate.

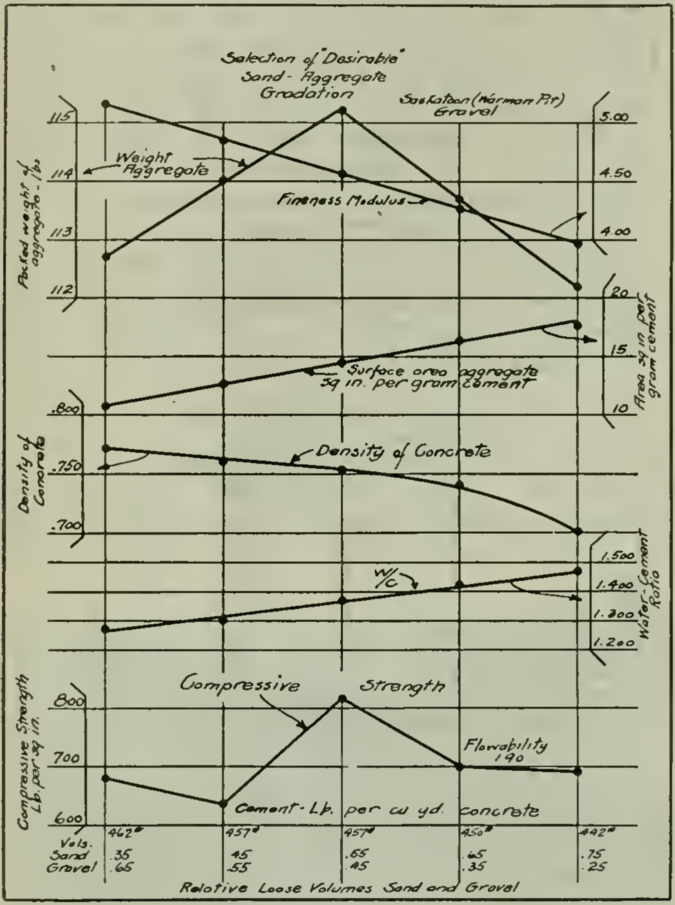

Figure 3.

A comparison of compressive strength and calculated values of density of concrete, water-cement ratio, fineness modulus, and surface area of aggregate per gram of cement. The maximum density, water-cement ratio, and surface area theories would select the 35–65 sand-gravel ratio while strength tests indicate the higher sanded combinations to be more desirable.

Application of the Maximum Density Theory

The relation of these test results to the maximum density theory can be seen in Figures 3 and 4. The curve for density of the concretes in Fig. 3 shows that density decreases as ratio of fine aggregate increases. The highest strength was not found for the concrete having maximum density. In Fig. 4 the granular analyses of the dry concretes, including cement are plotted in comparison with the Fuller maximum density curve. While the maximum density curve no doubt represented the best aggregate grading of the particular aggregates from which it was derived it is very apparent that this curve bears no relation to the gradings found for Saskatoon aggregates. The attempt to apply the Fuller curve to the problem of choosing the best gradation in this case would result in the selection of the .35–.65 sand-aggregate relation, which is a harsh working, segregating combination. The wide variation in aggregate grading which may be used without strength reduction casts doubt upon the value of any single gradation curve. As shown in other tests, normal sand may be regraded to have twice its original surface area and yet produce a concrete equal in quality to concrete in which the normal sand is used, which is in accordance with the curves in Fig. 4 since the two gradation curves under such conditions would be separated even farther at the left of the diagram than the gradings shown. As was found for the previous theories, the maximum density theory would lead to the selection of a low sand ratio combination which would be less suitable in every respect than a higher sanded combination.

Results of Step No. 1

Summarizing the results of Step No. 1, it may be said that a high sanded aggregate containing a larger proportion of sand than gravel has been found to be the desirable combination for these particular aggregates, and that all of the well known proportioning theories would select an aggregate combination which would result in harsh working, segregating concretes of lower compressive strength. Results seem to indicate that the aggregate combination having the highest unit-weight will furnish a concrete of high strength when cement contents and flowabilities are equal. This apparent rule, which requires more study to demonstrate its value, is not relied upon, but selection of the "desirable" combination is based upon compressive strength tests.

As a result of the test data obtained in Step No. 1 the .55–.45 sand gravel combination is selected for concretes to be made of these particular aggregates. Step No. 2 involves determination of the strengths of concretes containing different percentages of cement for the wettest and driest consistencies employed in practice. Five different cement contents were chosen, .10; .14; .18; .22 and .26. These values denote the ratio of the volume of cement in the batch to the sum of the volumes of fine and coarse aggregate measured separately. For example, in the .10 cement batch one bag of cement would be used with 5.5 cu. ft. of sand and 4.5 cu. ft. of gravel. Flowabilities of 160 and 200 were employed, the first being a plastic consistency about as dry as is ordinarily used in practice and too dry for most structural work and the latter about as wet as need ever be used except in exceptional cases.

Compressive Strength Tests

The results of compressive strength tests of these concretes are shown in Fig. 5. The two lower curves represent the range of strengths for variation of cement contents and flowabilities. Directly above is shown the number of pounds of cement per cubic yard of concrete needed to attain any particular strength value shown, for a flowability of 200. At the top are shown the number of cubic feet of sand and gravel required for each bag of cement for any particular concrete. The ratio of cement to volume of aggregate indicated at the bottom of the diagram is only used for convenience in the laboratory in computing the quantities of materials in each batch and is not needed in the practical use of the diagram.

In practice this diagram would be used as follows: A 1000 pound concrete is specified and from the nature of the work it is known that a flowability of about 200

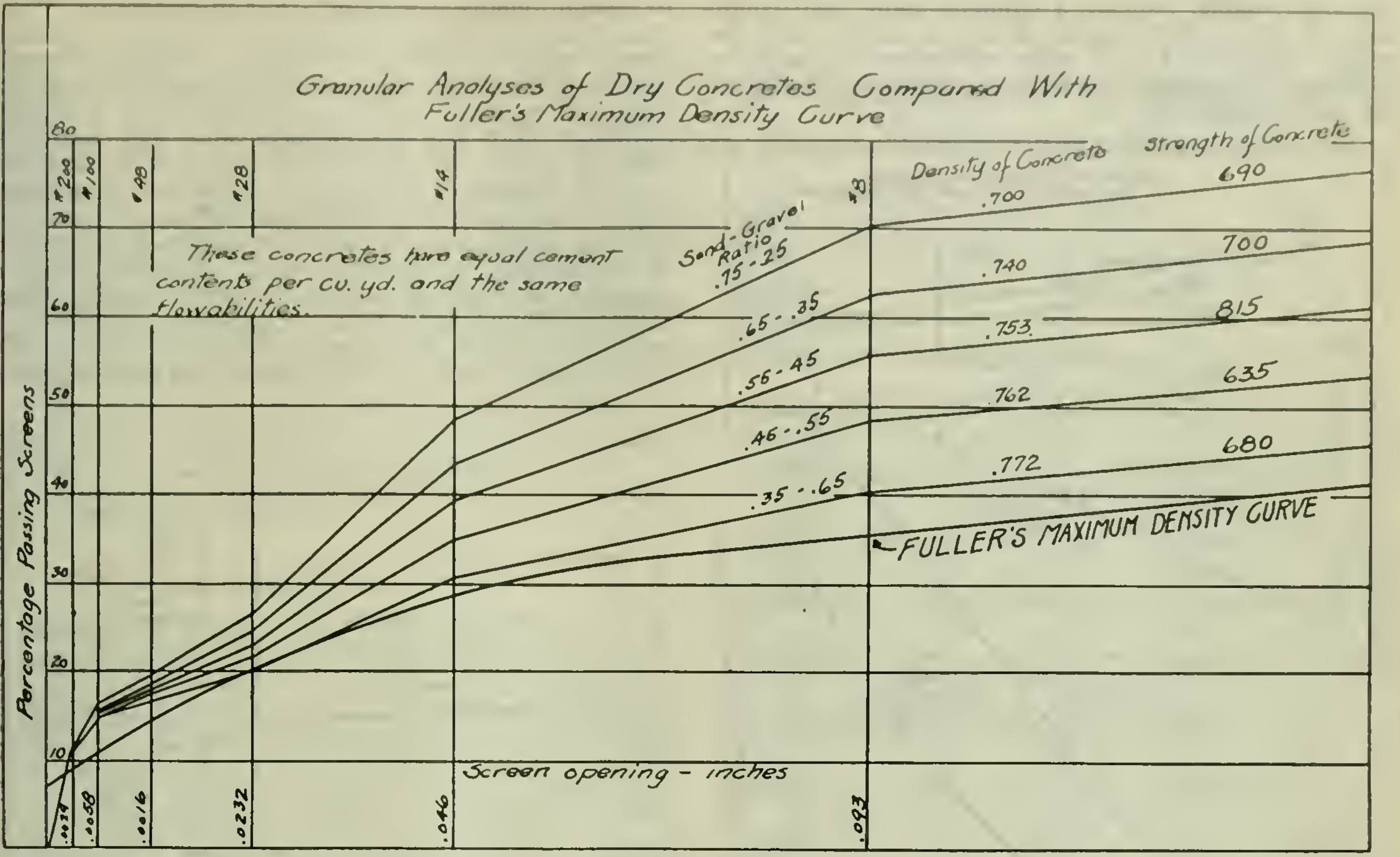

Figure 4.

Granular analyses curves of the five concretes compared with Fuller's Maximum Density Curve. It is seen that these curves are spread over a wide range and that the maximum density theory offers no assistance in the selection of the "desirable" sand-gravel combination.

will be needed. At the intersection of the 1000 line with the strength curve for flowability of 200 project vertically upwards to the cement line where it is seen that about 560 pounds of cement will be required for each cubic yard of concrete. Continuing vertically upward the volumes of sand and aggregate required per bag of cement are found to be 2.0 gravel 2.5 sand. The same information can also be obtained from Fig. 6 where the upper curves of Fig. 5 have been plotted to a larger scale. It has been common practice to state required volumes in terms of barrels of cement and cubic yards of aggregate per yard of concrete and such values are shown in the upper portion of Fig. 6. The 1000 pound concrete requires 1.6 bbls. of cement, .48 cu. yds. gravel and .60 cu. yd. sand per cubic yard of concrete.

Incidentally it is interesting to note that these diagrams substantiate the earlier statement that a 1—2—4 concrete of practical working consistency too often fails to attain a strength of 2000 pounds per square inch at 28 days. Such a concrete will contain about 480 pounds cement per cu. yd. From Fig. 5 it is seen that 480 pounds cement in a concrete having a flowability of 200 will not justify a strength assumption over 700 pounds per square inch with these particular aggregates.

It will be noted that many of the concretes shown in Fig. 5 have abnormally low strengths and would never be specified in practice. The original cement contents were chosen on the assumption that the .18 cement content, practically equivalent to the commonly specified 1—2—4 relation would result in a compressive strength of 1400–1800 pounds and from 600–900 would be expected for the .10 cement content. The results obtained illustrate the method employed, but to be of greatest practical value the two lower cement contents should be dropped and ratios of .30 and .34 added.

The data included in Figures 5 and 6 redrawn to a larger scale furnishes the working diagram for use by the engineers or architect and the contractor.

Field Tests

In practice the values shown in Figures 5 and 6 should be checked by field tests of concretes which are prepared under a proper system of inspection. This may be considered as Step 3. As previously pointed out, the many variable factors encountered in field practice may furnish strength results under the most efficient system of field inspection, differing considerably with those obtained in the laboratory. There has as yet been no opportunity to check completely the values shown in Figures 5 and 6 with field results. However, the many tests of field concretes on file in this laboratory indicate that field concretes equivalent to a 1—2—4 mixture in cement content have a strength of 400–900 pounds at 28 days. Values obtained when proportions were carefully checked and consistency was held down to the minimum usable, indicate a strength under such conditions of 600 to 800 pounds, closely in accord with the results shown in Fig. 5 when allowance is made for difference in condition of cement, aggregate quantities, curing conditions, etc.

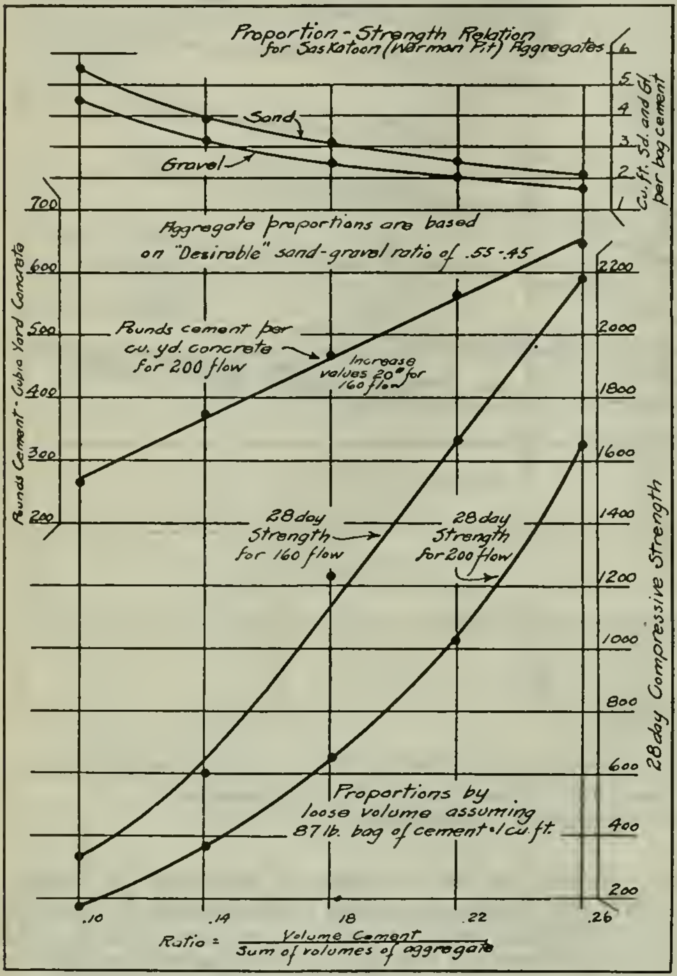

Figure 5.

Strengths of concretes for wide ranges of flowability and cement content using the selected sand-gravel combination. Such a diagram as this, after it is properly modified by results of field tests, furnishes the basis for selection, in advance, of mixtures to result in concrete of any desired quality for Warman Pit aggregates. Upper curves indicate the quantities of aggregate required per bag of cement in the batch.

Importance of the Proposed Scheme of Proportioning

The use of the above outlined scheme of proportioning will not only definitely establish quantities which must be used to insure any required strength, but will simplify the work of preparing the specification for concrete work. With definite information at hand it will not be necessary to assume blindly a working stress in design and at the same time to specify proportions which cannot possibly furnish concrete of the design quality. Definite strengths can be specified and the quantities of cement, sand and aggregate required can be easily and fairly accurately estimated both by the engineer and the contractor. All guess work as to quantities and costs can be eliminated and the planing of concretes to fulfil any requirement can be made just as systematic and convenient in advance of actual construction as the determination of the quantity of form lumber or reinforcing steel. A proper system of inspection to check up quality of concrete actually placed will place the whole problem of production of concrete of specified strength on a sound basis and react to the advantage of the owner, the engineer and the contractor.

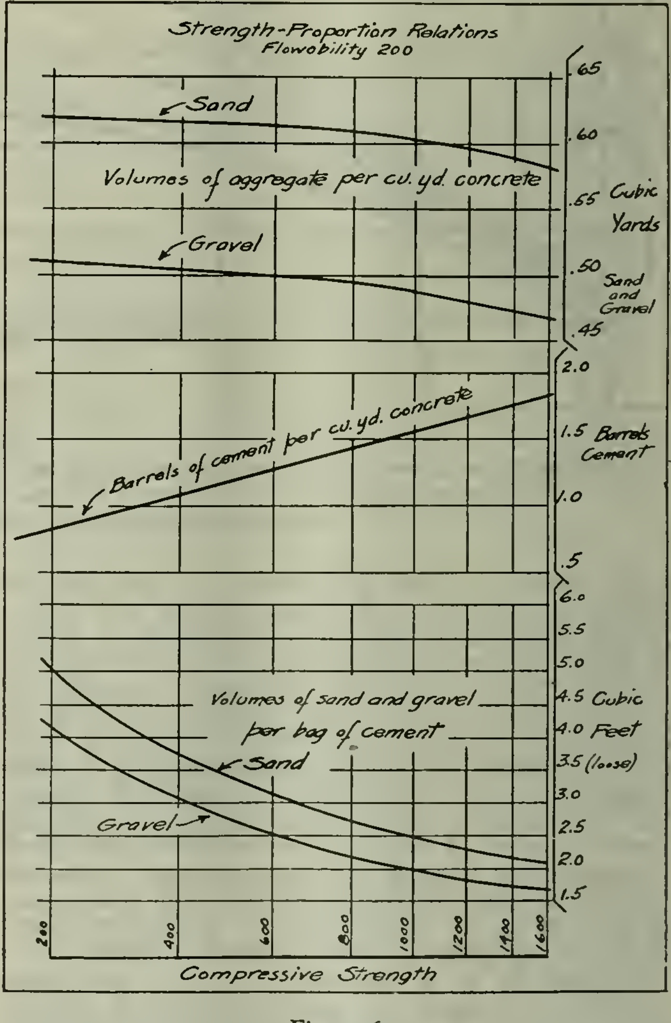

Figure 6.

The data of Figure 5. is shown in another form to aid in calculating quantities of materials required to result in a concrete of predetermined quality, and quantities of materials per cubic yard of concrete.

Some Features of the Design of Locomotives Introduced for the Purpose of Modifying their Effect on the Track

The effect of static load, dynamic augment, impact, lateral flange thrust and abrasion on locomotive design.

Frank Williams, A.M.E.I.C.

Read before Moncton Branch, The Engineering Institute of Canada, Feb. 10th, 1920.

The destructive forces exerted by a locomotive on the rail may be roughly classified under the following headings:—

Static Load, Dynamic Augment, Impact, Lateral Flange Thrust and Abrasion.

Static Load

The Static Load is merely the dead weight of the locomotive on the rail and in order that a correct distribution of weight may be maintained at all times the locomotive is suspended on a system of equalizers and springs which have the effect of compensating for any slight irregularity of track such as low rail joints, etc. Nearly all locomotives in North America are hung with what is virtually a three point suspension, that is to say that there are three separate systems of equalizing beams and springs. For example, on our Mikado freight engines the engine truck and the first and second drivers are equalized together, the third and fourth drivers and the trailing truck on the right side are covered by another set of equalizers, and the third and fourth drivers and the trailing truck on the left side by an exactly similar arrangement. The centres of equilibrium of these three systems of levers are the three theoretical points of suspension and when designing a locomotive, the centre of gravity of the live weights has to be so located as to distribute the proper proportion of weight to each of these three points; the weight is then distributed to the different pairs of wheels by means of the equalizers according to the desired axle loading.

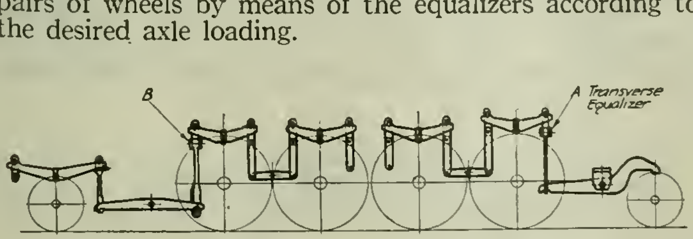

Figure 1.

Figure 1 is a sketch showing the springs and equalizers of the locomotive in question. It will be noticed that there is a transverse equalizer at "A" which allows any excess load to be distributed to both sides of the locomotive and connects the front arrangement into one system. The two back systems are separate from each other, as the so called transverse equalizer at "B" is not really an equalizer in any sense of the word, but merely a very convenient mechanical arrangement for connecting the trailing equalizer, which is set slightly diagonally, to the back driving spring hanger.

In case there may be any who do not understand the advantage of a three point suspension, let them consider a four legged table standing on an uneven floor so that only three legs come in contact with the floor. If this table be slightly rocked until the fourth leg touches the floor you can see that all the time the table is in motion the load is carried on only two legs. A three legged table, on the other hand, will accommodate itself to an uneven floor and each leg bears its fair share of the load.

The arrangement of the spring rigging varies on different classes of locomotives to suit the wheel arrangement, but the three point idea is always adhered to and a correct weight distribution maintained even though the track may be in bad shape, as it is bound to be at times in a climate like our own.

Dynamic Augment

This is a term usually applied to the excess load which comes on the rail at every revolution of the driving wheels as a result of the centrifugal force of the overbalance in the wheels.

It is a matter of impossibility to balance perfectly all the forces which disturb the smooth running of a two cylinder engine at high speed. The side rods, crank pins, crank hubs, back ends of the main rods and the effect of the eccentric crank when used are rotating weights, and are all completely balanced in the particular wheels which carry them; the disturbing forces which cause all the trouble are due to the reciprocating movement of the pistons, piston rods, crossheads and the front end of the main rods.

In order to obtain a perfect balance, these reciprocating weights would need to be balanced by other reciprocating weights and this can be very conveniently done in a four-cylinder balanced engine, but with the ordinary two cylinder engine this is out of the question and we have to resort to the expedient of increasing the balance weight in each driving wheel a certain amount in order to counteract the fore and aft vibration imparted to the locomotive by the rapid movement of the reciprocating parts.

The bone of contention for many years was how much of this reciprocating weight should be balanced and how much left unbalanced. If we balance too great a proportion of this weight the effect of the overbalance on the track may be severe and if on the other hand we balance too small a proportion, it will be impossible for the crew to ride on the footplate at high speeds owing to the excessive vibration, moreover the engine would soon go to pieces in service.

In the early days of locomotive building various proportions of the reciprocating weights were balanced with varying success; the proportion varied from 50% to 75% of the total, 66% being the proportion adopted by most railroads. Later the engineers realized that the weight of the locomotive itself was a factor which should enter into the question, as it is self evident that a light engine with comparatively heavy reciprocating parts will be more subject to this fore and aft vibration than a heavy engine with comparatively light reciprocating parts.

The method then adopted was to take one four-hundredth of the total weight of the locomotive from the weight of the reciprocating parts on each side separately and then balance the remainder, this amount of counterbalance being evenly distributed between all the driving wheels.

The results obtained by this method were very good in the great majority of cases but experience proved that at very high running speeds it still left something to be desired and in 1915 counterbalancing methods underwent a radical change as the result of a report submitted by a committee appointed by the American Railway Master Mechanics Association to investigate the matter.

The chief point established by this committee was that reciprocating parts were usually heavier than necessary and that the total weight of these parts should not exceed a certain definite ratio to the total weight of the locomotive.

As a result of the conclusions arrived at by the committee the rule generally adopted by locomotive designers to-day is to keep the total weight of the reciprocating parts on each side of the locomotive below 1/160 part of the total weight of the locomotive in working order and then balance one half the weight of these parts, distributing this overbalance evenly between all the driving wheels.

The dynamic augment caused by the centrifugal force of the overbalance is then checked in order to make sure that it will not exceed one half the static load on the rail when the locomotive is running at a speed in miles per hour equal to the diameter of the driving wheel in inches.

If the centrifugal force of the overbalance were to exceed the static load on the rail at any particular speed the wheel would actually lift clear of the rail every time the counterbalance weight went over the top centre, or if the centrifugal force were only slightly less than the static load and the locomotive happened to be rolling a little, it might lighten the static load at the instant when the counterbalance weight was passing the top centre and the same condition would obtain; but when the locomotive is balanced in accordance with the present day method it will be agreed that there is no chance of the wheel lifting under any service conditions.

It is generally conceded by engineers who have made the closest study of these matters that dynamic augment is not in itself specially destructive to the track, but if it should be great enough to lift the wheel it will be accompanied by impact and in this case it might be very serious.

Impact

The term "Impact" is applied only to a sharp hammer blow delivered directly on the rail in order to distinguish clearly between this and the dynamic augment. If the dynamic augment is destructive, it is only mildly so, but impact is one of the most destructive forces with which the track maintenance department is troubled.

It has been pointed out that it is possible to cause impact by using an excessive amount of overbalance in the driving wheels. The most common cause of impact is a flat spot in a tyre, this may be the result of a skidded wheel or the shelling out of a piece of the tread of the tyre. This condition is rigidly covered by our Maintenance Regulations and the locomotive is immediately taken out of service if a flat spot is found 2½ inches long.

Lateral Flange Thrust

For many years the fact has been recognized that a locomotive in road service must be guided, or the alignment of the rails will be seriously disturbed by the wheel flanges. This guiding is the duty of the engine truck.

Speaking generally, passenger engines are equipped with four wheeled trucks and freight engines with two wheeled trucks. A freight engine having a higher tractive effort than a passenger engine, therefore needs more adhesive weight and on this account less weight is carried on the truck. The high speeds at which the passenger engine operates make the four-wheeled truck desirable for this class of service although the two-wheeled truck has excellent guiding qualities even at comparatively high rates of speed.

On the early designs of engine truck the centering arrangement was merely a flat slide with a couple of light springs one on each side, working in opposition to each other. This arrangement gave very good satisfaction on the locomotives of that period, but would be useless on the locomotives of to-day as the truck has to swing quite a distance off the centre before any considerable centering thrust could be exerted by the spring.

This device was superseded many years ago by the swing link. In this type of truck the swing bolster was suspended from the swing frame by four straight links as shown in Fig. 2.

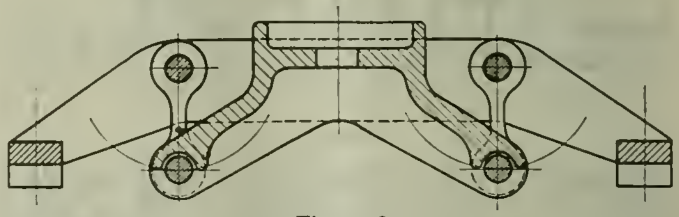

Figure 2.

This truck was a distinct improvement on the earlier type but it had the same inherent disadvantages in a milder degree. The initial centering effect is nil and therefore this truck could do very little guiding when the locomotive was running on a straight track.

Though it may not seem reasonable to the uninitiated, it is just as important that a locomotive should be guided on a straight track as on a curve and for this reason the swing links were changed to a two point suspension as shown in Fig. 3.

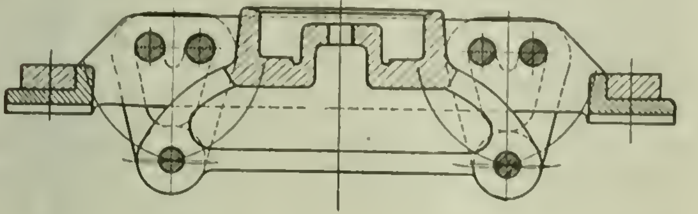

Figure 3.

It will readily be seen from this sketch that in whichever direction the truck swings off the central position there is an immediate centering effect, and by properly proportioning the links this may be fixed at the desired percentage of the weight on the truck. It is common practice to make the initial centering effect about twenty per cent of the weight on the truck.

This type of truck has excellent steadying and guiding qualities on straight track and moderate curves, but it is not well suited to very sharp turnouts where a wide swing of the truck is required, as the resistance to side swing or the centering effect increases very rapidly as the truck gets further off the center, owing to the sharp angle which the swing links assume under these conditions.

In order to design a truck of this type for very sharp curves it is generally found necessary to cut down the initial resistance to prevent the possibility of the outside wheel being lifted from the rail by the pull of the swing links at their greatest angle and this of course is detrimental to the steadying qualities of the truck.

It can be seen from this that a truck with a constant resistance is greatly to be desired and many attempts were made to develop such a truck. Eventually the "Woodard" truck, which was first manufactured by the American Locomotive Company, was placed on the market and this design appears to meet with all requirements.

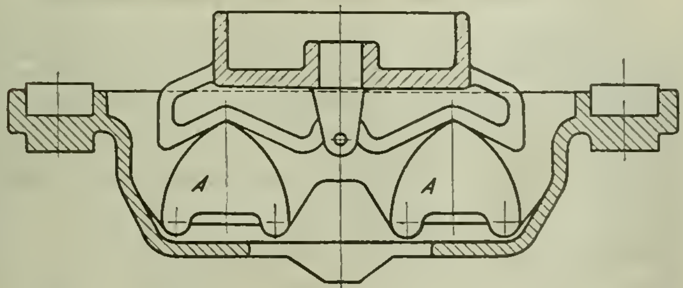

Figure 4.

It will be seen from Fig. 4 that the centering arrangement of this truck is a radical departure from previous practice, the swing links are discarded and the swing bolster rests on the rocking pieces "AA" in such a way that in whichever direction the truck swings, the swing bolster has to roll up an inclined plane. These inclined planes, the height of the rocking pieces and the spacing of their pivot points may be so arranged as to make the centering effect of the truck equal to any desired percentage of the weight on the truck and, whatever this percentage may be, it remains the same even though the truck may swing to its extreme travel.

By using a truck of this type it is possible to increase the initial resistance to side swing to about fifty per cent of the weight on the truck and this gives it a great advantage in steadying and guiding qualities over the swinging link type.

When a trailing truck is used on a locomotive it is given only a very moderate centering effect, for although this resistance to side swing has a beneficial effect in steadying the locomotive on a straight track, it will negative a certain amount of the guiding action of the engine truck when rounding a curve. The only object of giving side play to the trailing truck is to provide a flexible wheel base for rounding curves.

When five pairs of driving wheels are used as on our Santa Fé locomotives the front pair of drivers is given lateral play in order to cut down the rigid wheel base and give greater flexibility, and on extremely heavy power articulating is resorted to for the same reason.

Abrasion

Abrasion of the rail may occur from several different causes. The driving wheels of a locomotive often slip when a heavy load is being started; this should not happen on a perfectly clean rail *as the factor of adhesion is high enough to take care of the maximum tractive effort*, but there are so many conditions which may lower the coefficient of friction between the tyre and the rail that this cannot be altogether guarded against.

The writer has occasionally seen a locomotive slip for a certain portion of every revolution of the driving wheels when working very hard on a grade; this is generally due to the valves being out of square so that the poor distribution of steam imparts an uneven turning moment to the driving wheels. This condition is not common and may easily be rectified by properly setting the valves.

Any abrasion caused by faulty braking is bound to be very much more destructive to the wheels than to the rail so that we are not likely to have much trouble on this account.

The most rapid abrasion is probably caused by the grinding of the wheel flanges against the side of the rail on curves and turn-outs and this evil is mitigated as far as possible by making the wheel base flexible as is practicable by the methods mentioned before when dealing with lateral flange thrust.

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VOL. IV. May 1921 No. 5

An Opportunity for Service

Business depression is not to be camouflaged and denied even if hopes for better conditions are of the highest. It is undoubtedly a fact that Canada, in common with the rest of the civilized world is caught in the backwash from war prosperity and the Canadian business world's current watchword is "Ca' canny." This cautiousness in launching out into new ventures naturally affects the professional engineer, more especially the younger man who has not had the experience necessary to make him indispensable to his employer, and to put it plainly, work for the trained engineer is not so plentiful as it was.

Now *The Engineering Institute* has an Employment Bureau for the benefit of its members and the usefulness of the service has increased and is increasing daily as its work becomes known. But there are two sides to co-operation and *The Institute* Employment Bureau cannot have its maximum efficiency until every member who is an employer comes to regard the local Branch Secretary as the first man to seek when he has a vacancy for an engineer. Frequently Institute Headquarters receives letters acknowledging service in securing suitable engineers, and more than one of the large pulp and paper companies in Eastern Canada has adopted the custom of writing to the Secretary whenever a vacancy occurs. Every member of *The Institute* in an engineering executive position should adopt this as a settled policy.

In addition to publishing notices in the Employment Bureau section of *The Journal*, these notices of positions vacant are mailed to all Branch Secretaries if received more than one week before date of publication of the journal. In this way the employer is sure of wide publicity within a short space of time. A service of benefit to all is a list of engineers seeking better positions. This list on file at Headquaters gives a summary of technical experience and is consulted whenever an enquiry for an engineer is received. An extension of this service is to be put into force by which a copy of such listings will be mailed to the Branch Secretary nearest to the applicant's address. The Branch Secretaries will thus be kept in touch not only with Positions Vacant but with engineers in their locality who may be available.

The advantages of such a system to the employer are very evident. In the first place the service is free; secondly it is nation-wide; finally as *The Engineering Institute* includes over 4000 engineers of all grades the Employment Bureau of *The Institute* is the logical place to look for an engineer.

The Engineer and the Community

In another section of *The Journal* will be found a condensed report of the first meeting of the Social Service Committee appointed recently by Toronto Branch. In many respects this report is noteworthy, and Toronto deserves considerable credit for its pioneer work in this direction. In more than one of the valedictory addresses delivered by retiring presidents of *The Institute* the call has been sounded to the engineer to think more of his duties as a citizen, to take his due place in the administration of civic and national affairs. It is evident that this call is being heeded. One of the striking features of the report referred to is the important place reserved for the engineer in social service work by virtue of his special qualifications.

The engineer is, in fact, concerned directly with social service work in his profession, and it is most natural that this contact should be extended beyond office hours. The opportunities offered in this connection are endless; one of the most obvious being the education of the public at large to the benefits of good housing schemes, proper city planning, etc. The engineer is not supposed to be as eloquent as his brethren in other learned professions, but his training is such that the statement of facts in simple and logical language is his by right, and this is the very style needed. Of course this is only one way of applying enthusiasm, there are organizations whose purpose it is to further all schemes of improvement, and it is to the engineer's advantage not only to form study groups with his professional brothers, but to mix with others in unselfish work for humanity.

Town Planning Notes and Comments

H. L. Seymour, A.M.E.I.C.

NOTE:—*In order to make this column of wide interest to members of The Institute, personals and items of town planning interest will be appreciated. Address: H. L. Seymour, A.M.E.I.C., 40 Jarvis Street, Toronto.*

Town Planning Institute of Canada

In this column considerable information in regard to the Town Planning Institute of Canada has already been given. The general experience of such organizations in a country like Canada would indicate that the success of such an Institution is a function of the activity of its branches.

It is only necessary to follow the press notices to feel assured of the activity of the Ottawa Branch, which has been established for a couple of years. The Ottawa Branch has an energetic executive with Noulan Cauchon, A.M.E.I.C., as Chairman and Major D. H. Nelles, M.E.I.C., Secretary. The Vice-Chairman is Lieut-Col. C. P. Meredith, architect, the other members of the executive being: — Noel Ogilvie, M.E.I.C., A. A. Dion, M.E.I.C., J. L. Rannie, A.M.E.I.C., and W. L. Cassels, surveyor.

Since its inception the Ottawa Branch has taken an active part in town planning matters with particular reference to the city of Ottawa. During its first season the Federal Plan Commission's report of 1915 was discussed with much benefit to the members. This last season's interest has centered around the Ottawa Town Planning Bill as well as such matters as the removal of the Cross Town Railway Tracks.

The action of the Ottawa Branch has no doubt given wide publicity to and greater interest in town planning matters.

The Toronto Branch is hardly a year old. It is really only a few months since it officially became a Branch although the Toronto members of the Town Planning Institute held previously several meetings largely of an organizing nature. The officers of the Toronto Branch of the Town Planning Institute as now elected are: Messrs. A. V. Hall, landscape architect, Chairman; H. L. Seymour, A.M.E.I.C., Vice-Chairman; G. Phelps, A.M.E.I.C., Secretary-Treasurer; and these with Messrs. J. P. Hynes, A.M.E.I.C., architect, and N. D. Wilson, A.M.E.I.C., make up the executive committee.

In Montreal it is hoped that next year an active Branch will be formed. There are several members of the Town Planning Institute in Canada's largest city who have been very active in Town Planning matters. One of these well known to engineers is James Ewing, M.E.I.C.

Town Planning Education

At several Canadian Universities the indication is that shortly there will be regular Town Planning Courses. At McGill this year a course of lectures was delivered under the auspices of the Commission of Conservation. Six of these lectures were given by Thomas Adams, town planning adviser of the Commission and two by W. D. Cromarty, his architectural assistant. The course was optional for Civil Engineering students in their 3rd and 4th years while it was compulsory for architectural students in senior years. The course of lectures dealt with the objects and effects of Town Planning. Numerous slides were shown of cities where considerable attention has been given to planning,—including such centres as Paris, Washington and Edinburgh. The need for detailed topographical contour maps was stressed; also the need of co-ordination between the work of the architect and the engineer was particularly emphasized. At the close of the lectures a topographical plan of an estate was submitted to the students who were required to town plan it. The engineering students were to pay particular attention to matters of water supply and drainage, architectural students to the layout of streets and parks. It is understood that this year an examination will be held on town planning subjects at McGill.

At the University of Toronto there has also been a course of lectures this season under the auspices of the Commission of Conservation while Professor Berrington of the Architectural Department of the Faculty of Applied Science has also contributed. In this column it is expected that there can be announced next month detailed particulars of next season's Town Planning course. An important feature is the inclusion of an intensive course during the month of January particularly arranged not only for students but for graduates and others interested in Town Planning. This should meet the needs of a number of engineers who have been making a request for this very thing, who can spare a month in the winter but who do not find time otherwise for the reading along town planning lines that they would like to be able to spend.

The writer has often been asked as to suitable town planning text books. An endeavour will be made in future to review or comment on town planning literature. As a guide to a few suitable books it might be mentioned that for these to be prepared for full membership in the Town Planning Institute of Canada the following texts have been recommended:—

For Engineers — The Planning of the Modern City—Nelson P. Lewis, (E.I.C. Library 971-L67).

For Architects — Town Planning in Practice—Raymond Unwin.

For Surveyors — Rural Planning and Development — Thomas Adams, Commission of Conservation Report.

For Landscape Architects — Introduction to Landscape Architecture—Prof. Hubbard and Theodora Kimball.

A few years ago, it was a comparatively easy matter to read all town planning literature. The time has now arrived, however, when it would seem that one would almost have to make a choice from the numerous books, reports, pamphlets and magazines devoted wholly or in part to town planning.

Of most value to engineers there might be mentioned the reports that were prepared in connection with the districting or zoning of New York. These are: Reports of the Heights of Buildings Commission—1913, and Report of Commission on Building Districts & Restrictions—1916. A detailed study of the latter is considered by the writer to be well worth while. The engineer can gain an excellent idea of the material that should be collected and the information that should be obtained for the purpose of comprehensive city planning and zoning. Many reports have been prepared since this date, but the 1916 New York report probably affords the best general reading.

CORRESPONDENCE

Definition of "Engineer"

April 18th, 1921.

Editor, *Journal*:—

Dear Sir:

The Editorial in the current issue of *The Journal* under the caption "Abuse of the Term 'Engineer'" is very timely. I enclose an advertisement recently published in a local paper which shows very clearly that a certain class of workman has adopted the term "Engineer" to describe his calling, and it would appear that the press and public generally understand the term Engineer to mean a man in overalls with the usual accessories such as a hammer or a piece of oily waste. An American dictionary before me describes an Engineer as "one who runs an engine" so that this class of men have some authority for applying the term to themselves.

The Institution of Civil Engineers of Great Britain are I believe considering the use of the term "Chartered Engineer" to distinguish a member of that institution, and the description seems to me to be very applicable. We also are operating under a charter, and it might be worth while to consider the use of this term to describe our own membership. The public fully understands that a Chartered Accountant has a professional standing far above that of an ordinary accountant, it might therefore be expected that the title of "Chartered Engineer" would convey a proper conception of the professional standing of the person so described.

Proper legal steps would need to be taken to protect the title, but this could no doubt be arranged for.

M. H. Marshall, M.E.I.C.

Copy of Advertisement

Engineers

The International Union of Steam and Operating Engineers will meet at the Labor Temple, Saturday, April 9th, at 8 p.m. Applicants for membership are especially invited to attend. The others are well organized, — "Where are you?"

411 Lancaster Building,
Calgary, Alta.

A Tribute to our Employment Bureau Service

April 8th, 1921.

Editor, *Journal*:—

Dear Sir:

We have your letter of March 23rd, with reference to the vacant position in our drafting room, and wish to state that it will not be necessary to advertise this position as you suggest, as we have now filled the position from applicants who were apparently notified from your office by letter.

We thank you for the trouble you have gone to and the assistance you have given us in this connection.

Yours very truly,
The Turnbull Elevator Company, Limited,
Per W. G. Turnbull.

The Turnbull Elevator Company, Limited,
126 John Street,
Toronto, Ont.

Meeting of Main Committee of Canadian Engineering Standards Association

A Meeting of the Main Committee of the Canadian Engineering Standards Association was held at Ottawa on April 4th, Sir John Kennedy Hon. M.E.I.C., in the Chair, and the following were some of the more important matters dealt with:

Sir John Kennedy was re-elected Chairman; T. A. Russell and H. H. Vaughan, M.E.I.C., were re-elected Vice-Chairmen, and Dr. J. B. Porter, M.E.I.C., was re-elected Honorary Secretary-Treasurer.

The following gentlemen were welcomed as members of the Main Committee:

J. B. Reade, Purchasing Commission of Canada; G. A. Mountain M.E.I.C., Board of Railway Commissioners for Canada; Lt.-Col. E. W. Stedman, The Air Board; Dr. L. V. King, McGill University; T. F. Sutherland, Canadian Institute of Mining and Metallurgy.

A large number of additions to the membership of various sectional and sub-committees were approved, and thirty gentlemen, members of various working committees, were elected to membership in the Association.

The Annual Report and Financial Statement to be issued to members of the Association, were presented and approved.

The attendance of R. J. Durley, M.E.I.C., Secretary, at the Conference of Secretaries of national standardizing bodies in London on April 25th was approved. This Conference is of an informal nature and is intended to facilitate the interchange of information and data regarding standardization, especially in its international aspect, and with regard to planning the methods of intercourse and co-operation to be adopted between the various national standardizing bodies. It is expected that the meeting will be attended by delegates from Belgium, Great Britain, Canada, France, Holland, Italy, Sweden, Switzerland, and the United States. Each Secretary will naturally present a report on the work of the Conference to his Committee or Council on his return.

The activities of the Association during the past year and the present state of the work of the various committees are briefly covered by the report.

Among the subjects on which the Association has recently been requested to take action may be mentioned the following:

A request from the Air Board has been made for the preparation of specifications for certain aircraft materials which cannot be obtained under commercial conditions in Canada, the wartime specifications of the British Air Board being much too elaborate for use under peace conditions. The necessary committees are being arranged for.

Co-operation with the American Engineering Standards Committee has been requested in connection with the Aeronautical Safety Code, the American Safety Code for Logging and Sawmill Machinery, and the American Committee which is considering the standardization of parts of elevator machinery.

Requests for co-operation have also been received from the Canadian Electric Railway Association and the American Gear Manufacturers' Association.

In connection with the work of the Sub-Committee on Portland Cement, which is engaged in revising and redrafting the Specification for the material originally issued by the Canadian Society of Civil Engineers, the Main Committee approved of the suggestion of the Sub-Committee as to the desirability of experimental work on Canadian cements with regard to the best method of determining normal consistency. The Main Committee also directed that arrangements should, if possible, be made with the proper authorities for the standardization of cement sieves in Canada.

The meeting terminated with a vote of thanks to the Executive Committee and the officers and staff of the Association.

The meeting of the Main Committee was followed by the Third Ordinary General Meeting of the Association, which was largely of a formal nature, and during which the Annual Report and Financial Statement were presented and approved.

EMPLOYMENT BUREAU

To make this department more valuable it is proposed that in future advertisements of situations vacant should state salary, and give details of requirements.

Situations Wanted

Civil Engineer

Civil engineer, age 30 with thirteen years experience on city and railway work. Good draughtsman, instrumentman and general office man would like steady position with consulting engineer or contractor. Salary $175.00 per month. Box 70-P.

Civil Engineer

Civil engineer, M.E.I.C., age 31 years. Graduate of Dalhousie University and Nova Scotia Technical College in 1913. Experience:—municipal, town planning, model town construction and harbour improvement. Both office and field work. Four years an officer in Canadian Engineers, C.E.F. Now out of employment due to large Pulp and Paper Company, closing mills and stopping construction. Box 71-P.

Members Exchange

K. and E. engineer's transit for sale, 6 inch circle, good condition, $80.00. Box 13-A.

Errata

In the article on "Relay Protective Features" published in the April Journal, the dividing line under table three should have been between "Total" and "Lightning", "double line shorts" referring only to the last three columns to the right.

The Organization Meeting of the Corporation of Professional Engineers of the Province of Quebec

The organization meeting of the Corporation of Professional Engineers of Quebec was held at the headquarters of *The Engineering Institute of Canada*, 176 Mansfield street; Montreal. Civil engineers from all parts of the province were present and Albert R. Decary, M.E.I.C., Quebec, presided. Several questions of interest to civil engineers were discussed.

The elections to council gave the following results: Members for Montreal District: Messrs. C. N. Monsarrat, M.E.I.C., Arthur Surveyer, M.E.I.C. and J. M. Robertson, M.E.I.C.; Quebec District: J. E. Gibault, A.M.E.I.C. At a subsequent meeting of the Council the following officers were elected: President, A. R. Decary, M.E.I.C.; vice-president, K. B. Thornton, M.E.I.C., secretary, Frederick B. Brown, M.E.I.C.; the other councillors are: Messrs. Arthur Surveyer, M.E.I.C., C. N. Monsarrat, M.E.I.C., J. M. Robertson, M.E.I.C., A. B. Normandin, A.M.E.I.C. and J. E. Gibault, A.M.E.I.C.

Engineering Legislation in Ontario

The Professional Engineers Act for Ontario, drafted by the Advisory Conference Committee, was introduced into the Ontario Legislature by Major A. W. Gray, M.L.A. for Leeds, and a member of *The Institute*.

Second reading was given it on April 20th, after which it together with the Architects Bill was referred to a Special Committee, to be named, as is customary in such cases by the Premier.

As soon as reported out of Committee it will come before the House again for third and final reading. The Bill as introduced and printed is in substantially the form already published, and the Advisory Conference Committee has every hope that it will be finally passed without material change.

LIBRARY NOTES

Great Arches (Grandes Voûtes) by Paul Séjourné, chief engineer of roads and bridges; chief engineer of construction service Paris-Lyons-Mediterranean Railway Co.; Professor in the National School of Roads and Bridges, Bourges, France, 1916. Tardy Pigelet et Fils. Six quarto volumes. Profusely illustrated.

Reviewed by H. M. Mackay, M.E.I.C., M.Am. Soc. C.E., Professor of Civil Engineering, McGill University, Montreal.

This great work is, so far as the writer knows, unique in modern engineering literature. The author proceeds in accordance with a proposition tersely enunciated in the foreword "One builds an arch in accord with arches already built; it is a matter of experience." While this maxim may not be literally accepted, there is enough truth in it to make a collection of data regarding the principal masonry and concrete arches of the world a work of great value.

Such a record the author provides in a manner entirely worthy of his subject. Limiting himself to spans of 40 metres and upwards, he gives an unusually complete account of some two hundred structures ranging in period from the fourteenth century to the present time. Most of the examples are naturally taken from continental Europe, but all the principal British and American structures coming within the field surveyed are also included.

The first three volumes are devoted to hingeless arches. Synoptic tables for each group in the author's classification give as full data as possible regarding the dimensions, materials, stresses, decoration, foundations, centering, methods of construction, quantities and costs. A system of symbols at once comprehensive and simple makes it possible to bring before the eye an immense amount of information at one time. Each structure is then treated separately in a critical and descriptive monograph detailing points of interest in its history, accidents and mishaps included, and also describing methods of construction and notable features. These articles are profusely illustrated by photographs, often of great beauty, and by well executed drawings of details. Sources of information are fully given in foot notes and in the case of some of the earlier structures old documents are freely quoted, thus adding greatly to the historic interest. The work is that of a scholar as well as an engineer, who has a full sense of the value of the past.

Vol. IV. deals in a similar way with articulated arches.

The general title of Vol. V. is "What Experience Teaches as to all Classes of Arches in Common." Limitations of space preclude even a catalogue of the topics, but it may be sufficient to say that an even and judicious balance is preserved between aesthetic and practical considerations. While some details under the latter head may be more appropriate to European than to Canadian practice, no engineer can well afford to neglect the opportunity which M. Séjourné's work offers of studying all that makes for beauty in such structures. The author's point of view as to decoration may perhaps be best expressed in his own words, which are worth noting, "In a bridge, decoration should serve solely to distinguish the different members, to mark and accentuate the purpose and importance of each. But it should form a part of the very substance of the work: it should not be capable of being detached---------It should be sober, discreet, modest, reasonable, useful. It should be in accordance with the scale of the bridge; visible from the point of view from which it is to be regarded."

In Volume VI., designated as an appendix, viaducts and culverts are fully treated. An important section of this volume is, however, devoted to the mathematical analysis of the elastic arch. The method employed follows Culmann and Ritter in developing influence lines graphically by means of the ellipse of elasticity. This method which is gradually creeping into American textbooks will probably enjoy wider use as it becomes better known.

To sum up, the author has fairly made good the statement in the preface that "The engineer charged with the design and construction of an arch will find in this work what has been done, what should be done and what should not be done." Even readers who do not follow the French text readily will find abundant matter to repay them in the admirable photographs and drawings.

The price (300 francs) would be formidable under ordinary circumstances, but at the present rate of exchange it works out to a very moderate sum considering the character of the work. These volumes will prove a valued addition to the library of all engineers who take a pride in the history of their profession; all who are engaged in the design and construction of masonry and concrete arches; and all architects who collaborate with engineers in such structures.

Standard Specifications for Steel, published by the Steel Company of Canada, Hamilton, Ont.

This hand-book of 84 pages is made up of specifications published by the American Society for Testing Materials, Lloyds' Register of Shipping, the Master Car Builders' Association, and the Association of American Steel Manufacturers. The specifications issued by the American Society for Testing Materials cover structural steel for bridges and buildings, concrete reinforcement bars, carbon steel forgings for locomotives, tie plates, track bolts, etc., those issued by Lloyds' register cover ship and boiler steel, steel castings and steel forgings. Following specifications for steel axles issued by the Master Car Builders' Association come tables of standard specifications published by the Association of American Steel Manufacturers, covering standard variations in weight of angles, tees, rounds, flats, etc., and standard methods of sampling for check analysis.

OBITUARY

Major A. T. Tomlinson, M.E.I.C.

Major A. T. Tomlinson, M.E.I.C., who died after a prolonged illness on January 20th was born at Grand Falls, N.B., in 1859. Major Tomlinson served as a young man in the Northwest Rebellion, was later employed in railway construction in the Western States, including construction of the Pike's Peak Railway Co., and on the Denver & Rio Grande Railway. Moving in 1890 to New York, he was appointed assistant engineer with the Brooklyn Elevated Railway. He was connected with subway and elevated work in New York, Boston, Chicago and the Eastern States until 1905. In 1905 Major Tomlinson, who had been with the J. G. White & Co., was transferred to their Canadian Branch and was connected with the construction of hydro-electrical development at Cedars, Que. and was employed on the construction of Grand Trunk Pacific, Torchwood Hills to Saskatoon. In 1908, Major Tomlinson was appointed district engineer sections C & D of the Grand Trunk Pacific Railway, during one year having entire charge for contractor. From 1912-1914 he was chief engineer in charge of surveys and location of the proposed railway from Montreal to James Bay, and during the war was Major with the Canadian Engineers in charge of inspection of small arms ammunition in Dominion Arsenals.

Major Tomlinson who was elected M.E.I.C., in January, 1906, was a 32nd degree Mason, a member of Consistory number two, of Cedar Rapids, Iowa. He was also a member of Rameses Temple Mystic Shrine of Toronto. He is survived by his wife, a son and two daughters.

PERSONALS

H. L. Mahaffy, S.E.I.C., has been appointed town engineer of Montreal West, Que.

*

Jos. Moreau, S.E.I.C., is now with the engineering department of the United Fruit Co., at Guaro, Cuba.

*

C. M. Smyth, J.E.I.C., has been appointed superintendent of light & power department of Cape Breton Electric Co. Ltd., Sydney, N.S.

*

F. A. McGiverin, A.M.E.I.C., recently with Canadian Steel Foundries, Ltd., Montreal, has accepted a position with Harvard Turnbull & Co., Toronto, Ont.

*

A. G. McLerie, A.M.E.I.C., has accepted a position with the Laurentide Company, Ltd., at Grand Mere, Que.

*

George Coutts, A.M.E.I.C., has resigned his position as good roads engineer at Bertile, Man., in order to accept an appointment as assistant engineer, Trent Canal, Department of Railways and Canals, Peterborough, Ont.

*

F. H. Kester, A.M.E.I.C., has been promoted from the position of acting designing engineer to construction engineer with the Canadian Bridge Co., Ltd., at Walkerville, Ont.

*

Lt. Col. Monsarrat, M.E.I.C. and P. L. Pratley, M.E.I.C., have formed a partnership as consulting engineers specializing on bridge foundations, steel work, concrete construction, with an office in the Drummond Building, Montreal.

L. W. Klinger, A.M.E.I.C., has been appointed district irrigation officer on special projects in Mesopotamia and expects to be engaged in that work for the next year or longer.

*

F. C. Wightman, A.M.E.I.C., who was town engineer for Amherst, N.S., from 1918 to 1920, and who accepted a position with the Provincial Highways Board of Nova Scotia as Superintendent in May last, has again accepted an offer from Amherst and assumed the duties of town engineer on March the 15th.

*

Bruce Aldrich, A.M.E.I.C., chemical engineer, has resigned his position as district engineer of the Asphalt Association, in charge of the Canadian District Offices, 95 King St., E., Toronto, and has become associated with Kilmer & Barber, Ltd., 10 Adelaide St., E., Toronto.

*

New Member of Council

Charles Conyers Kirby, M.E.I.C., recently elected Member of Council, was born at Newport, Mon., Wales, in 1880, educated at private school, high school and technical school. He was articled pupil to C. Kirby & Son, civil engineers, Newport, in 1898, and in 1903 was appointed engineer to Cowbridge Rural District Council on design of sewage and sewage disposal works. From 1904 to 1907, Mr. Kirby was assistant engineer with Kirby, Son & Brown, Newport and London.

CHARLES CONYERS KIRBY, M.E.I.C.

In 1907 Mr. Kirby came to Canada and was first leveller on location survey Kingston, Smith's Falls and Ottawa Railway for the Grand Trunk Railway. In 1908 he was appointed engineer and superintendent for the construction of reinforced concrete substructure of the Sacred Heart Church, Ottawa, later he was resident engineer Canadian Pacific Railway, Quebec division, Montreal. Since 1909 Mr. Kirby has been in the service of the Canadian Pacific Railway, first as resident engineer Montreal terminals and later as assistant engineer to engineer maintenance of way Montreal. In 1915 Mr. Kirby was appointed district engineer for New Brunswick district, Canadian Pacific Railway, St. John, N.B. which position he holds to date.

Mr. Kirby has been one of the strong men of the St. John Branch of *The Engineering Institute;* he was Chairman of the Branch for 1919 and is at present on the Executive. The engineers of New Brunswick owe a big debt of gratitude to Mr. Kirby for his part in the passing of the act in 1920 incorporating the Association of Professional Engineers of the Province of New Brunswick; he was appointed provisional president and this appointment was ratified at a general meeting of the Association held last September.

*

Appointment to Alberta Irrigation Council

Gavin N. Houston, M.E.I.C., Chairman of Calgary Branch, and at present acting commissioner of irrigation with the Dominion Reclamation Service at Calgary, has been appointed a member of the provincial irrigation council, under the new act passed at this session of the legislature. Mr. Houston will be named as Secretary of the council and will devote his entire time to that work. His office will be in Lethbridge and his duties will require his attention to the detailed business of the council, the responsibility of which is greatly increased under the Lethbridge Northern Irrigation District Guarantee Act.

Mr. Houston came to Calgary from Colorado in 1913 and entered the employ of the Dominion Irrigation work, acting as expert adviser on important irrigation questions for several years. He returned in 1918 after an absence of two years, to the post of assistant commissioner, and has acted as commissioner for some time past during Mr. Peters' absence in Ottawa.

During the time he has been in Calgary he has taken a very active part in the affairs of *The Institute*, and his appointment to this important post is welcomed by the members of the Branch as a fitting recognition of the good work he has done in the irrigation field, and as a very wise move by the provincial authorities. The policy adopted by the province of guaranteeing bonds of irrigation districts was the result of a large public demand, but had the application of the policy been left to political handling, it could easily become a menace to the solvency of the province through unwise expenditures by the several districts. Mr. Houston's appointment to this most important post is considered a guarantee of honest and prudent expenditure of public funds in irrigation development in the province.

Incoming Councillor

STUART STIRLING OLIVER, A.M.E.I.C.

Stuart Stirling Oliver, A.M.E.I.C., is a true representative of the Province of Quebec. He was born in Quebec City in April 1858, educated at High School and Morrin College, Quebec and was received as a Quebec land surveyor in April 1880. For the next three years Mr. Oliver was in private practice, and from 1884 to 1893 was assistant engineer on surveys and location, Quebec and Lake St. John Railway. He was then appointed engineer in charge of the Great Northern Railway and was later auditor of the Quebec and Lake St. John Railway. Since 1910 Mr. Oliver has been connected with the Quebec Railway Light and Power Company, from 1910 to 1917 as a right of way agent and since 1918 as purchasing agent.

Mr. Oliver has been a strong supporter of *The Institute* in Quebec, in 1911 he was Secretary and in 1912 Chairman of the Branch, he has been an associate member since 1887, the year of Canadian Society of Civil Engineers was founded.

BRANCH NEWS

Vancouver Branch

J. N. Anderson, A.M.E.I.C., Secretary-Treasurer.

A luncheon, under the auspices of the Branch, was held in the Indian Grill, Hotel Vancouver, on Thursday, 24th, March at 12.15 noon.

Major G. A. Walkem, M.E.I.C., presided over an attendance of fifty, among whom were the principal officers of the local branch of the Good Roads Association of Canada and of the Vancouver Automobile Club.

The guests of honour were S. L. Squires, Toronto, Chairman of the Executive, Good Roads Association of Canada and Russell T. Kelley, Hamilton, member of the Executive, Good Roads Association of Canada.

Mr. Squires explained in detail the various amounts into which the $20,000,000 allotted by the Dominion government for the highway was subdivided.

"It is up to every province in the Dominion to further good roads; we must have them," declared Mr. Squires on opening his address. "We have got to have more roads and it is up to every province in the Dominion to further this work. That good roads are a source of, not only advertisement, but of actual revenue to any commonwealth has been proved too often for me to comment on here. It may mean an outlay of money at the start, but in the long run it will retro-act to the benefit of everyone.

"Selfishness in the matter of road construction must be a thing of the past," continued the speaker. "In the matter of appropriations the province has had excellent aid, but the people themselves must treat this matter in a different light than they have in the past.

"In the beginning, the provinces of British Columbia and Alberta must get together. This is necessary by reason of the fact that there has to be a connecting link between these two great provinces. Without co-ordination this scheme of a Trans-Canada highway will not succeed.

"According to the government plan of allotment the province of British Columbia has now an appropriation of $1,250,000. This may not be adequate, but it certainly is a great step in the way of furthering the highway. Every other province in the Dominion has one and there is no reason why British Columbia and Alberta shall not have one. And they will."

Mr. Kelly stated that what the Dominion wanted most was to keep the farmer on the land.

Too many people are leaving the farms for the city, he maintained.

"People have to eat," declared Mr. Kelley, "and if we don't have farmers, where are the people of the city going to get their foodstuffs? That is one of the great causes of the high cost of living. They can talk about war and inflated prices, post-war inflation and all that, but I want simply to demonstrate that 'without a sower we can have no harvest'. For that reason men must hang on to the farms. They must be imbued with the spirit that they are feeding the world. For so they are. And without them, we who cannot farm will be confronted with a problem that will tax our greatest diplomats to fathom.

"Few people, I think, realize what good roads have meant to other provinces in the Dominion. In the province of Ontario motorists, coming across the border simply because they could find good roads, spent $8,000,000. And this vast sum was expended for mere costs of travel. It does not include any purchases, but merely gas, repairs and general expenses contingent on motoring."

The Vancouver Branch held a dinner in the Citizens Club, on Friday, 8th April, the guest of the evening being Fraser S. Keith, general secretary of *The Institute.*

The Branch Chairman, Major G. A. Walkem, M.E.I.C., presided and the following members were present. Messrs. White, Kennedy, Smaill, Bonnycastle, Powell, W. G. Swan, R. G. Swan, Brakenridge, Frith, Mills, McGown, Fairhurst, Wm. Young, W. B. Young, Hamilton, Bradley, Williams, Brown, Foreman, Labrie, Stirrett, Johnston, Crysdale, Eddy, Parham, Rindal, Bristol, Archibald, Idsardi, James, Buchan, Tornroos, Muirhead, J. M. Anderson, J. N. Anderson and Stowe. The only toast was that of the King. Major Walkem, in introducing Mr. Keith, gave a resumé of the Branch activities.

Mr. Keith gave a long and interesting talk on the various present day functions of *The Institute,* in the course of which policy, remuneration, legislation, and the relationship of *The Institute* to similar technical bodies were fully discussed.

Mr. Keith invited questions from those present on any matters about which information was desired.

This having been taken advantage of and various members having paid high tribute to the work being accomplished by Mr. Keith, the meeting then turned to a lighter mood.

Messrs White and Kennedy, the oldest members of *The Institute* present, gave racy reminiscences of their early professional days which were very much enjoyed.

Messrs Fairhurst and Foreman were responsible for songs and recitations of a high order. Several members contributed anecdotes both engineering and otherwise and the meeting concluded by those present giving three cheers accompanied by musical honours for Mr. Keith.

*

On the day of Mr. Keith arrival in Vancouver, the Executive Committee of this Branch held an informal luncheon meeting for him at the University Club.

Mr. Keith's visit which had been looked forward to with keen anticipation was very helpful and the feeling was generally expressed that these visits to the West might be more frequent as they undoubtedly bring the Branches much closer to headquarters.

*

D. O. Lewis, M.E.I.C., having resigned the Presidency of the Association of Professional Engineers of the Province of British Columbia, the Council at their meeting of the 5th March (under Section 9, Subsection (i) of the Engineering Profession Act) elected Major W. G. Swan, M.E.I.C., to the Presidency, and J. A. M. Dawson (chemical engineer) to the Vice-Presidency (vacant through the election of Major Swan to the Presidency), and F. W. Guernsey (mining engineer) to the vacancy on the Council caused by the election of Mr. Dawson to the Vice-Presidency.

At the meeting of the Council held on the 9th March, E. A. Wheatley was appointed Registrar and Secretary of the Association, said appointment to take effect 15th of April next.

Calgary Branch

Arthur L. Ford, M.E.I.C., Secretary-Treasurer.

On Friday evening, April 15th, a dinner in honour of Fraser S. Keith was given in the ballroom of the Palliser Hotel, at which a large and representative gathering of the Branch partook of good food and comradeship.

Gavin Houston, M.E.I.C., Chairman of the Branch presided at the head of the table and outdid himself as host and toastmaster. The ice of reserve was broken by Gilbert Patrick, A.M.E.I.C., in some of his humorous songs, by Alfred Chapman, A.M.E.I.C., at the piano, leading the gathering in popular airs, and by several members in contes drôles.

In a very apt introduction, the toastmaster opened the way for Mr. Keith's talk on the activities of *The Institute.* Mr. Keith's talk showed that our Secretary is not only in close touch with the activities of the parent Institute, but as well with the aspirations of the individual Branches. He covered the ground so thoroughly that little opening was left for questioning him at the conclusion, and he left the feeling with each member present that his visit had marked a distinct step forward for the Branch and for *The Institute* as a whole in welding the organization to a common purpose with an intelligent scheme for the betterment of the status of the engineer and for the better interchange of knowledge of the profession.

Particularly was he able to tell us of the work of the Policy Committee and Remuneration Committee and of special reasons why their reports have not yet been made public officially, and he promised that when they become public, as great a step forward will be expected, as when the report of the committee on society affairs was brought in some four years ago. That report marked the beginning of a period of greater activity in *The Institute* than had been known in its history, and since that report was brought in, the number of active members has been multiplied by three.

Mr. Keith very modestly refrained from mentioning that the period of greater activity has been coincident with his term as Secretary, and that the life of *The Journal* likewise coincides.

In his reference to *The Journal,* it was most gratifying to hear that *The Journal* is now paying its way. United support is, however, still needed to get behind *The Journal,* and build up its character as a medium for the exchange of professional knowledge, its circulation, and its advertising value.

Mr. Keith's talk formed the basis of some discussion, mostly of an order of congratulation for the good work he has done and in appreciation of the value his visit has been to the Branch. George Craig, M.E.I.C., in his inimitable style congratulated *The Institute* on the activities that have resulted from Mr. Keith's association with it as an active Secretary, and he also touched on the publicity campaign of the Branch that is getting away to a good start as evidenced by the masterly address given to the Board of Trade by Alex. Dawson, M.E.I.C. at noon. His comparison of the wages paid to garbage collectors as compared with engineering salaries emphasized the need for concerted action to bring about adequate remuneration for trained technical men.

Brig.-Gen. Harold McDonald, M.E.I.C., responded to a toast from the Chair to those present, and in a lighter vein he injected good spirits and an appreciation of the pioneer work of the older members. His eulogies of William Pearce, M.E.I.C., Alex. Dawson, M.E.I.C., and of Turner Bone, M.E.I.C., were interspersed with bits of wit and repartee of a very light order. His reference to Mr. Pearce as the dean of the profession in Alberta touched a responsive chord in the hearts of all present, and at the conclusion of Gen. McDonald's remarks "Mr. Pearce" was heard from the lips of the gathering. He responded very fittingly and took advantage of the occasion to put forward the need of the North Saskatchewan River Irrigation project.

Mr. Turner Bone spoke briefly but most effectively, continuing the lighter vein of repartee, and the welding of past engineering facts to the present.

R. A. Brown, President of the Alberta Association of Professional Engineers was present and he presented hopes for the continued good feeling of engineers for each other, and of the opportunities that exist for the improvement of their status.

*

Thomas W. Collinge, Affiliate of the Calgary Branch died in April, at the age of 60 years. He did not practise as an engineer in Canada and as he had not applied for corporate membership in *The Institute*, few local members knew this cheery, gray eyed man as a structural engineer of notable experience. Articled to A. Handyside and Co. of Derby and London, he continued in their employ after completing his apprenticeship, serving for many years in responsible positions. With a large force of draftsmen under his command in the office and an erecting force at his command in the field, he designed and erected many bridges and steel buildings, among which are the following: Swansea steel bridge; Montevideo central station; Hotel Metropole, Brighton; Hotel Majestic, Harrogate; reconstruction of Victoria station, London; additions to Liverpool St. station, London; removal after collapse and renewal of Charing Cross station roof; some 30 bascule bridges; pontoon and swing bridges at Liverpool and Hull docks; buildings for Armstrong, Whitworth & Co.; Savoy Hotel, London, and many others.

After 32 years with the one firm, he was left somewhat at loose ends when the firm went into liquidation in 1910. In 1912 he moved to Calgary and entered the real estate business. When war broke out and real estate activity ended, he accepted a clerical position with the C.P.R., there being at the time no demand for structural engineers.

Never knowing a day's illness until shortly before his death he had quite a record as an athlete and sportsman, having been stroke for Derwent rowing club, a rugby player for Notts county and a golfer at Derbyshire Golf Club.

Edmonton Branch

C. C. Sutherland, A.M.E.I.C., Secretary-Treasurer.

A special meeting of the Edmonton Branch Executive was called Monday, April 18th, in the MacDonald Hotel, to meet the General Secretary, Fraser S. Keith. A very interesting discussion lasting over three hours, took place, covering the various problems and activities of *The Institute* and Branch.

A luncheon of the new Engineering and Construction Section of the Board of Trade was held in the MacDonald Hotel on Tuesday at noon. It was appropriate at this meeting to have Mr. Keith, General Secretary of *The Engineering Institute of Canada*, present and give an address on "The Engineers' Place in Civilization". About fifty engineers and contractors were present, indicating a live interest in this section.

The general meeting and dinner of the Edmonton Branch was held in the King Edward Hotel on Tuesday evening, April 19th. Following the dinner, F. H. Link, geologist with the Imperial Oil Co., who was in charge of the party that located their well at Fort Norman, gave a very interesting illustrated lecture, covering the geological work in the Mackenzie Valley Basin up to the time of their first successful well.

The speaker traced the recording of oil, indications throughout the various reports starting from the time of Mackenzie discovery down to the present day activities, showing the difficulties that had to be overcome in gathering this information.

It was worthy of note that in the final location of their successful well, which Mr. Link made from their general geological map and other detail information gathered by them on the ground, agreed very closely with the proposed location decided upon previously and independently by the chief geologist.

At the present time much is heard about the great possibilities of the oil discoveries in the North and of the fortunes that are to be made. Commenting on this, Mr. Link pointed out that there was much still to be done in the way of investigations, and probably many mistakes will be made, and numbers of "Dry" holes drilled before definite conditions could be predicted.

The cost of this investigation would be heavy. Their first well cost about $125,000, it taking from twelve to sixteen months to get their equipment in. To build a railway would cost over $30,000 per mile and when one realize that Fort Norman was only about 100 miles from the Arctic Circle, one begins to get an idea of what it will mean to develop the Northern oil field in the Fort Norman District.

Following the lecture, the General Secretary, Fraser S. Keith, addressed the Branch, outlining the activities of *The Institute*. In doing so, he referred to the increase in membership from 1800 in 1918 to the present membership of 4500. However this increase in numbers, represented only a small part of the activities because for every member that took an active part in 1918, there were ten active members today. A second great change that had taken place was in the attitude of some of the older members to get together with the younger members for the general good of the "individual" in *The Institute.*

Mr. Keith then outlined the work that the different committees now have under way with special reference to those on "Policy" and "Remuneration". The Committee on Classification and Remuneration would submit their report in a short time, defining eight classes with a schedule fixing fees for each class. With this report adopted by Council, it is proposed that the Committee on Policy will be asked to define ways and means of putting it into effect.

The Edmonton Branch is interested in the ultimate volution of a body controlling Dominion wide interests of all classes, of engineers, and with this in view, Mr. Keith was asked particularly as to the attitude of the E. I. C. in this connection.

Winnipeg Branch

Geo. L. Guy, M.E.I.C., Secretary-Treasurer

At the regular meeting held in the University Buildings on 7th April, 1921, W. M. Scott, M.E.I.C., in the chair, a paper was read by C. H. Attwood, A.M.E.I.C., on "Regulation of the Winnipeg River."

Mr. Attwood dealt very fully with the various methods of estimating run-off, measuring stream flow and forecasting what would be the reliable minimum out-flow of a river supplied from any watershed. He showed from diagrams and curves how such results obtained on the Winnipeg River Watershed were worked up and applied directly to the Winnipeg River.

The meeting was a record attendance for the Branch and a very active discussion took place. The discussion dealt fully with the question of the affect of outside parties obtaining control of certain strategic points on the watershed. It was fully brought to the attention of the members the necessity of the control of any watershed being in the hands of a public body and not subjected to the control of private interests. Many of the speakers spoke highly of the valuable work which had been done by the Water Power Branch of the Dominion Government and emphasized the value of these reports to engineers dealing with water power projects in Canada. One of the speakers said that in many years' experience both in North America, Europe and South America he had never found records which could compare with those compiled by the Water Power Branch.

At the conclusion of the meeting a hearty vote of thanks was tendered to the speaker and the applause with which this was carried intimated the appreciation of the members for the excellent paper presented.

Among the business done during the evening was the acceptance by the Branch of the report of the Nomination Committee for members for 1921 and 1922 session.

Border Cities Branch

J. E. Porter, A.M.E.I.C., Secretary-Treasurer.

The regular meeting of the Border Cities Branch of *The Engineering Institute of Canada* was held in the Chamber of Commerce on April 15th. The minutes of the previous meeting were read and approved. A communication from Willis Chipman, M.E.I.C., dealing with objections which had been raised at the first reading of the bill dealing with legislation for the engineering profession was read. This communication was referred to the Executive Committee. The advisability of all members of *The Engineering Institute* allying themselves with the Border Safety Council was endorsed by Chairman Riddell. It was moved by Allen, seconded by Craig, that the Secretary be instructed to write the Windsor city council asking that a member of *The Engineering Institute* be appointed as one of the additional representatives from Windsor on the Essex Border Utilities Commission.

The paper for the evening was read by Major Anderson and dealt with Richibuctu break water. This paper was prepared by Mr. Stead of the Public Works Department of New Brunswick and was secured for presentation to the Border Cities Branch through the efforts of past Chairman Craig. It dealt fully with the investigation and progressive construction from 1906 to the present time. This item of construction has been a great boon to the fishermen located on the New Brunswick coast which is entirely without natural harbours.

Following the reading of the paper, it was discussed by Messrs. Craig and Forbes-Mitchell. Mr. Craig announced the removal of the Public Works Department offices to London to take effect about the first of May and this would probably be the last meeting which the Public Works staff would be privileged to attend as resident members of the Border Cities Branch. The loss which the Branch would sustain in the removal of six of its members was nicely expressed by Mr. Thorn and the entire Branch was unanimous in their regret of their departure on motion of Messrs. Thorn and Newman.

The following members were present:—Messrs. Craig, Molitor, Eastman, Newman, Forbes-Mitchell, Allen, Ridell, Thorn, Bowman, Anderson, Keith and Tillson.

We were pleased to see several visitors as well who we hope will shortly be active members.

Niagara Peninsula Branch

Rex. P. Johnson, A.M.E.I.C., Secretary-Treasurer.
G. R. Taylor, A.M.E.I.C., Branch News Editor.

A general meeting of the Branch was held on April 7th at the Thorold Engineer's Club, at which F. M. Dawson, A.M.E.I.C., research engineer of the Super Cement Company gave a very interesting address on Cement and Super Cement. The speaker gave a general outline of the process used in the manufacture of cement, and then paid particular attention to the physical properties and microscopic analysis of cements, illustrating his remarks with numerous lantern slides.

The results of a large number of tests on super cement were shown and compared to similar tests on ordinary Portland cement and these tests seemed to show that super-cement produced a concrete giving about 300 lbs. per square inch greater compressive strength than Portland cement. This was due to the more complete hydration of super cement and the speaker showed this by some very interesting microscopic slides. He also gave data showing that super cement possessed very high water-proofing qualities. Mr. Dawson explained that super cement was produced by the addition of a compound to ordinary Portland cement during manufacture, this compound being the patent of the Super Cement Company.

An interesting discussion followed the address and it was felt that super-cement was a material worth the careful consideration of engineers.

Toronto Branch

H. A. Goldman, A.M.E.I.C., Secretary-Treasurer.

March 31st.—Pulp and Paper Works—C. Nelson Gain

In the absence of the Chairman and Vice-Chairman, T. Linsey Crossley, A.M.E.I.C., occupied the chair.

The meeting was addressed by C. Nelson Gain of the Don Valley Paper Company, who discussed the subject of paper making and showed a number of interesting slides illustrating the developments of the industry and showing the importance of accurate mechanical adjustments in the speed control of the paper machine.

An interesting discussion followed, covering various points in the technology of pulp and paper manufacture.

A hearty vote of thanks was given to Mr. Gain. In replying Mr. Gain extended an invitation to all the members desirous of visiting the paper mill on Saturday 2nd April.

On Saturday afternoon, 2nd of April, several members of the Toronto Branch, E.I.C., visited the mill of the Don Valley Paper Co. in the Don Valley. Mr. Gain conducted the party through the mill and explained the various operations in the process of manufacture of paper. Owing to an accident, the mill was not in operation that afternoon, but another invitation to visit the mill when it is in operation was extended to the members.

April 7th — Canals — G. T. Clark, A.M.E.I.C.

G. T. Clark, A.M.E.I.C., gave an address on Canals. He outlined in a very interesting manner the historical development of the present system of canals in Canada. Special reference was made to the proposed canalization of the St. Lawrence River, giving some of the main engineering and economic features of the scheme. This lecture was illustrated by a series of lantern slides.

April 14th — The Engineer and the Contractor—W. E. Douglas, A.M.E.I.C.

W. E. Douglas, A.M.E.I.C., delivered an address on the relations between the engineer and the contractor. He urged that better co-operation be secured between engineer and contractor so that work could be done to the best advantage of those concerned.

April 21st — Code of Ethics and Election of Officers

At this meeting of the Branch, Prof. C. R. Young, M.E.I.C., presided.

T. D. Mylrea, A.M.E.I.C., Chairman of the Committee on Ethics, received expressions of opinion from the members of the Branch on various phases of the proposed code of Ethics. The form and extent of detail to be covered by the code and the desirability of having compulsory and penal clauses were discussed.

The Committee will continue this work and submit their report in due course.

Election of Officers

This was the last day for receiving ballots for the annual election of officers and executive of the Branch. The ballots were given to E. T. Wilkie, M.E.I.C., Chairman of the Committee of Scrutineers, who presented an interim report on the results later in the evening.

Results of the ballot for Officers and Executive Committee of the Branch for the ensuing year were as follows:

Chairman, — G. T. Clarke, A.M.E.I.C.
Vice-Chairman, — Wm. Storrie, M.E.I.C.
Secretary-Treasurer, — F. B. Goedike, A.M.E.I.C.
Executive: — Peter Gillespie, M.E.I.C.
G. G. Powell, M.E.I.C.
M. V. Sauer, M.E.I.C.
H. J. Lamb, M.E.I.C.
J. M. Oxley, A.M.E.I.C.
R. C. Muir, A.M.E.I.C.

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R. O. Wynne-Roberts, M.E.I.C., Chairman of the Branch, who has been confined to his home through illness for the past few weeks, has improved considerably and will resume his activities in a short while.

Report of Social Service Committee of the Toronto Branch

Thursday, March 24th, 1921.

Gentlemen:—

Your committee has held several meetings and has endeavoured to survey its field. We regret that employment elsewhere made it necessary for J. H. Bradley, A.M.E.I.C., to resign from this committee. R. G. Saunders, M.E.I.C., kindly consented to act in his place. As a principal in a contracting firm, he has come into contact with employment conditions, and taken an interest in the relations of employer and employee.

Taking advantage of power to add to our number, we have been fortunate in obtaining the co-operation of Wills Maclachlan, M.E.I.C., who will advise the committee on questions affecting industrial relations.

Social Service is coming to be recognized as a science, and it should be. Its motives must be based on the principle of the Good Samaritan, but its execution cannot be left to sentiment, unaided by a scientific approach.

The remarks of Mr. Beatty, Mr. Munro Grier and Dr. Kimball, at the Annual Banquet of the E.I.C., indicate that there is a call for the activities of engineers in the public service, not only as designers and builders of its physical structures, but as participants in the struggle for a better recognition of the rights and possibilities of its human component.

Mr. Beatty mentioned the elimination of "slumdom" as part of the work of engineers. This can best be brought about if the engineer has a direct voice in the decision for municipal activities. For that reason engineers should be found in city councils or on boards of control.

Dr. Kimball spoke of the entry of engineers into the administrative departments of industry, yet we seldom find the engineer named on boards of arbitration or conciliation, though he is known as a fair minded man with a balanced and judicial mental attitude. Why is this? It must be because neither party thinks of an engineer as a fellow citizen. He will continue to think this if engineers do not get into public affairs.

There should be co-operation between cities, suburbs and rural districts. Engineers who are used to taking broad views could be of great help in this work if they were to be found in the governmental bodies.

The community interest should be recognized in housing. This requires a broader view point in the individual, which the engineer could help to instil.

In educational matters fundamental changes are imminent in both primary and secondary stages. Expression gradually taking the place of repression and efforts being made to equalize opportunity.

In every way there is a need to lift the eyes and look beyond parochialism, provincialism, and even nationalism; — few men are better equipped for the cosmopolitan view than engineers.

The first report of this committee will be a brief review of the wide field of human relations in general. In future reports it is hoped that special phases will receive special attention, and it may be possible to provide that several evenings in next session be addressed by leaders in the various activities coming under review by this committee.

It has been arranged that each member of the committee read a brief paper on one of the subjects included in the purview of your committee. These are:—

City Planning,	by A. E. K. Bunnell, A.M.E.I.C.
Housing,	by Geo. Phelps, A.M.E.I.C.
Education,	by J. H. Curzon, A.M.E.I.C.
Social Service,	Prof. J. A. Dale, head of the Social Service Department of Toronto University has very kindly consented to come here and address us on this subject.
Capital and Labour,	by R. G. Saunders, M.E.I.C.
Industrial Relations,	by Wills Maclachlan, M.E.I.C.
Politics,	by T. L. Crossley, A.M.E.I.C.

These will be read in the order stated and it is requested that there be no discussion until all are read.

Your committee regrets that the breadth of field has not permitted thorough digestion of each presentation, and while these have been considered in draft to some extent, we must consider them as more or less the reports of sub-committees.

Realizing the importance of all these subjects in community and national life, your committee recommends that a committee of this nature be one of the regular standing committees of the branch.

Respectfully submitted,
A. E. K. Bunnell,
J. H. Curzon,
Wills Maclachlan,
George Phelps,
R. S. Saunders,
T. Linsey Crossley, *Chairman.*

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Abstract of Addresses to Social Service Committee

City Planning, A. E. K. Bunnell, A.M.E.I.C.

City Planning has assumed a new importance during the past few years on account of the great flow citywards. It has been learned, too, that good planning is beneficial not only to the general welfare of the community, but to the community's purse. Engineers should appreciate the problems of proper planning as these are mainly engineering. In Toronto, for instance, the principal problem at the present time is to prevent haphazard growth by the proper co-ordination of street planning, location of railways, street railways, etc. Already much important work has been done, but it remains for the engineer to carry on the work of educating the public to the value of good planning.

Housing, Geo. Phelps, A.M.E.I.C.

While it is pleasant to allow individual freedom, this is not always advisable in connection with housing schemes. Control is necessary to prevent overcrowding, to produce healthy living conditions, and to have a certain uniformity of style. Attempts in this direction have been made in Toronto, but in one case the houses were crowded, and in the other it was noted that no effort was made to stimulate the community spirit. In this connection it was noteworthy that before the boundary fences were erected between lots the community spirit was much more in evidence. In housing schemes allowance should be made not only for playgrounds, but for community meeting places where the spirit of neighbourliness will grow naturally.

Education, J. H. Curzon, A.M.E.I.C.

There is much to be done to put interest into primary education, to make education interesting, to promote independence of thought. To bring about these results the mercenary motive must not be unduly stressed and high ideals should be taught at all times. University education is weighted down with much work in the first year that should be transferred to the last year of high school. If this transfer were made, the university course would then be free to expand from its present specialization. While this specialization is necessary, particularly for the engineer in training, the course should be such as to turn out a man of general culture, and the efforts of Canadian universities in this direction should be encouraged.

Industrial Relations, Wills Maclachlan, M.E.I.C.

One of the penalties of the increasing use of machinery is the loss of the personal touch in industry. The day of the workman proficient in more than one special phase of work is steadily passing and the apprentice system of training is giving way to the training of the specialist. The engineer has played an important part in the development of machinery, but as yet has not turned his full attention to the solution of physiological and psychological problems connected with industry. A great deal remains to be done in the development of safety devices, improvement of lighting, ventilation and working conditions generally. The engineer should also take part in bringing together labour and capital in industrial councils, the first essential of the councils being that meetings of men and management to discuss problems should take place *regularly.*

Capital and Labour, R. G. Saunders, M.E.I.C.

The relations of capital and labour are of great importance to the engineer, as upon the nature of these relations depends to a large extent production for which the engineer is held responsible. Conditions have improved greatly in the past few years, due partly to the efforts of labour organizations, and also to the increased recognition by employers, as a class, of the necessity for better working conditions. It must be recognized that labour and capital are mutually inter-dependent, and that neither can exist without the other. Thus while capital must ever bear in mind to give fair play to labour, labour must also do its part in holding the agreements, in recognizing that the strike should be held only a weapon of last resort, and lastly in recognizing that labour is subject to economic laws fully as much as the product of labour. The remedy for depression lies in harmony between employer and employed, and in increased production.

The Engineer in Politics, T. L. Crossley, A.M.E.I.C.

An outstanding example of the engineer who made his mark on the life of the community at large was Sir Sandford Fleming, founder of the Royal Canadian Institute, advocate of Parliamentary reform, litterateur and citizen. Fleming believed that engineers should not mingle with politics in their present debased condition, but it is part of the engineer's duty to see that this condition does not become permanent. The present method of representation is faulty, and it is suggested that, in municipal affairs particularly, representation by occupation would produce better results. Whatever the system it must be such as to make the will of the community more vocal, at the same time preventing the sacrifice of public interests to those of private individuals. To reach this end engineers must be at home in politics.

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Social Service Work, Prof. J. A. Dale

Professor J. A. Dale, Head of the Social Service Departmeht, Toronto University, addressed the meeting briefly, describing the methods and programme of activities of the Social Service Department, and gave several illustrations from actual work being done, especially in connection with cases under the supervision of the Department, arising from Juvenile Court practice.

Peterborough Branch

R. L. Dobbin, M.E.I.C., Secretary-Treasurer.

The regular meeting of the Branch held on March 24th. was in point of numbers, if in no other respect, the most successful of the season. No less than 200 people were present, which constitutes a record for the Branch.

The subject was Pulp and Paper manufacture, and the speaker P. P. Westbye, M.E.I.C., general manager of The Wm. Hamilton Co. Ltd. certainly handled it well.

Five reels of moving pictures, detailing all parts of the subject, were shown and explained by the speaker.

The meeting on April 14th. was addressed by A. C. P. Blanchard, M.E.I.C., chief field engineer for the Hydro-Electric Power Commission, on the Chippawa Development.

He described the various construction methods in use on that great work, and illustrated his address with lantern slides and moving pictures.

There was a large attendance at the meeting.

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The Nominating Committee have made the following nominations for the coming Branch annual elections on May 12th.

Honorary Chairman: R. H. Parsons, M.E.I.C., city engineer.

Chairman: P. L. Allison, M.E.I.C., department engineer, C. G. Electric.

Vice-Chairman: Jas. MacIntosh, A.M.E.I.C., Hydro-Electric Power Comm.

Secretary: R. C. Flitton, A.M.E.I.C., William Hamilton Co.; D. L. McLaren, A.M.E.I.C., Canadian General Electric Co.

Treasurer: A. B. Gates, A.M.E.I.C., Canadian General Electric Co.; Geo. Perks, A.M.E.I.C., assistant city engineer.

Executive Committee: B. L. Barnes, M.E.I.C., W. M. Cruthers, A.M.E.I.C., A. L. Dickieson, A.M.E.I.C., R. L. Dobbin, M.E.I.C., H. O. Fisk, M.E.I.C., A. L. Killally, A.M.E.I.C., G. R. Langley, M.E.I.C., A. P. Millar, M.E.I.C., Allan Munro, A.M.E.I.C., W. G. Montgomery, A.M.E.I.C., Jas. MacIntosh, A.M.E.I.C., J. H. Reid, J.E.I.C., E. R. Shirley, M.E.I.C., P. P. Westbye, M.E.I.C.

Election ballots are being sent out, returnable at the annual meeting on May 12th. next.

Ottawa Branch

F. C. C. Lynch, A.E.I.C., Secretary-Treasurer.

The meeting of the Branch held at the Victoria Museum on April 7th, was addressed by F. W. Jenkins of the American Rolling Mill Company, Middletown, Ohio. Mr. Jenkins described the plant at Middletown as being one of unusual size, the production yearly being from 212,000 tons to 220,000 tons of finished steel. At the plant there are 30 miles of track, 11 engines and 130 freight cars for plant service, and a sidelight on the activity of the plant was given in the figures for water consumption, 5,000,000 gallons daily. After describing the open hearth and rolling mill equipment of the company, Mr. Jenkins described the process of manufacture from the receipt of the raw material, (pig iron) to the finished sheet.

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Research was the subject and Hume Cronyn M.P. the speaker at the meeting of the Ottawa Branch held on April 14th. There was a large attendance at this meeting over which Lt.-Com. C. P. Edwards, A.M.E.I.C., Chairman of the Branch presided.

Mr. Cronyn ventured to draw a distinction, which some failed to recognize, between pure, or fundamental science, and applied industrial science. He adopted Professor Huxley's definition of purely fundamental science as, a love of knowledge and the joy of the discovery of the cause of things. Pure science discovers; it endeavours to extend the boundaries of knowledge. Applied or industrial science is always conducted to obtain some utilitarian end. Pure science is discovered; applied science utilized.

Applied science was nothing but the application of pure science to particular problems. He stated that there was a large element in public opinion who believed that universities were the proper bodies to undertake industrial research. But the research council, which was composed of a majority of university professors, had decided that the university was not the proper place for applied science, and this agreed with the investigations also made in England, and the United States. The universities had a tremendous part to play, for without them research would die. They trained researchers. They were man-producing bodies, whereas research institutes wherever established were man-consuming concerns. Their objects were well known. Whoever could make two blades of grass, or two grains of corn, grow where only one grew before, would deserve better of mankind than the whole race of politicians put together. He reviewed what other countries had done in regard to applied science, and said that in U.S.A. apart from what the governments had done, the larger corporations had devoted enormous sums to the work of research. The great Mellon Institute was in one sense a commercial undertaking; in another sense it was not operated for profit.

Canada as a whole had done very little, said Mr. Cronyn in the way of aiding research, and practically nothing in aiding industrial research.

This was not to be wondered at, for the industries of Canada were not large or powerful enough to give the sums required for such purposes. The council of research was formed some years ago to survey the field, and report what they thought should be done, and generally to spread information and the gospel of research. The result of their work, consultations, and recommendations, was that they thought Canada should have a research institute established under federal supervision. The matter was referred to a select committee, and the finding of the research council was confirmed.

A strong recommendation was made to the Government that a research institute should be founded. The House of Commons approved it, members on both sides of the house speaking in support. The functions of the institute would be to enable Canadian industries to solve their problems to increase production, promote utilization of waste products, and natural resources of Canada. To them the main object undoubtedly was the aiding of native industries to get a place where there might be a rallying point at which a body of experts could advise as helpers in solving their problems.

Commander Edwards, in thanking Mr. Cronyn for his address said they recognized that with Canada's finances as they were at present, they had to measure research work in dollars and cents. It had to justify itself.

He urged that the council might make comprehensive study of the research activities of different government departments now existing, and that the best results would be obtained, not by ruthless transfer of those departments to the institute, but by co-operation with them.

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Apropos of the editorial in the April *Journal* regarding the improper use of the word "engineer", attention might be called to the latest adaptation of the word so far as Ottawa is concerned. Among other items with regard to recent additions to the Ottawa Public Library, as included in a statement given to the local press by the Librarian, W. J. Sykes, M.A., appears the following,—

"Mrs. Christine Frederick, *household efficiency engineer*, has written an excellent book called Household Engineering or Scientific Management in the Home. She gives the most up-to-date ways of housekeeping and applies principles of efficiency engineering and scientific management to the everyday tasks of housekeeping."

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C. G. Cline, A.M.E.I.C., has recently come to Ottawa to take up special water power work for the Department of the Interior. Mr. Cline has for several years been district engineer of the Dominion Water Power Branch at Kamloops, the centre of the dry belt district of British Columbia. He is a recognized authority on hydrometric survey work under irrigation conditions.

Montreal Branch

J. L. Busfield, A.M.E.I.C., Secretary-Treasurer

On March 14th a very interesting paper on "World Shipbuilding" was read by the author, H. R. McClelland, A.M.E.I.C., and was followed by an excellent discussion. In the discussion I. J. Tait, A.M.E.I.C., of the Canadian Government Merchant Marine, gave some interesting facts regarding the operation of the Canadian fleet. W. J. Alderson of Lloyds Register of Shipping spoke on the use of oil fuel and water tube boilers. W. I. Hay, of the British Corporation Registry of Shipping dealt with some of the technical points entering into the design and construction of ocean going vessels. A number of questions were asked by members and dealt with by the author.

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At the regular meeting on March 31st, the speaker was Chas. Desbaillets, M.E.I.C., formerly manager and chief engineer of the city of Sherbrooke, now engineer-in-charge, Montreal Water Board, who dealt with Hydro-Electric Plants and Public Utilities as a Main Factor in the Development of the City of Sherbrooke. After describing the hydro-electric plants owned by the city and known as the Rock Forest, the City and the Weedon Plants, the author gave an outline of the possibilities of the undeveloped powers owned by the city at Two-Miles Falls and at Westbury, and also referred to the distributing station and the system of metering.

In the year 1909, at the commencement of operations the assets of the Gas and Electricity Department of the Corporation were $351,000 and the liabilities $252,000, the profit and loss account being credited with $99,000. It was decided that all profits made by this Department would be deposited in the City's Treasury to pay for addition to plant equipment and improvements after having deducted from the profits the necessary amounts for sinking fund and depreciation. The result was that by 1920 the net profit accumulated amounted to $854,000,00. It is interesting to note from a study of the annual net profits that notwithstanding large deductions for the payment of interest on bonds for the purchase of the Two-Miles Falls plant the net profit has well maintained its proportion.

The speaker illustrated the effect of the availability and development of hydro-electric power by stating that in the year 1910 when only the City Plant was in operation the population was 15,000 and there were ten factories employing 450 people. Today there are forty-four factories employing over 6,000 people and the City's population has passed the 25,000 mark. In addition to the 6,000 horse power under its own immediate control about three thousand horse power is delivered by other companies namely the Shawinigan Water & Power and the Southern Canada Power. In this march toward progress the available electric power was the main factor and being offered at a reasonable cost induced the industries to locate in Sherbrooke.

Mr. Desbaillets pointed out that there is an average yearly income of $26,000,000.00 obtained from the development of water power in this Province and at the same time there has been spent for steam coal for power purposes $25,000,000.00 in a foreign country, and only $400,000.00 for Canadian steam coal. In other words we buy practically as much steam power outside as we buy electric power from ourselves and yet we have 6,000,000 horse power of undeveloped water power at our disposal.

The author pointed out that it should be the duty of every corporation, company or individual owning a water power even as small as 50 horse power to develop this power and dispose of it locally for the lighting of village, farms, etc. This policy would relieve the larger companies from the obligation to retail power along their large transmission lines necessitating the installation of extensive switching equipment, substations, etc. which are detrimental to the operation of main lines and which are often the cause of serious interruptions of large amounts of power even to the extent of tying up a large number of industrial concerns distributed over a big territory.

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On April 7th an address was given by M. B. Hastings of the Winter-Joyner Company, of Toronto, on Street Lighting. The importance of this part of civic improvement was made clear, and the speaker used a number of illustrations to advantage. It was stated that business in general reflected the merits or defects of a city's lights, and the speaker cited the example of Brantford, Ont., which suffered a severe business slump owing to the failure of the lighting system there some time ago. The error of improper maintenance was pointed out. It was a waste of public money to allow the lighting system to run down, and the policy of installing fixtures of good quality, even if a little more costly, was the wiser one. Distribution of lights was an important feature and was often disregarded. The public was not a good judge of light, and expert opinion should guide the installation of a system of illumination. Well-lighted streets were a great help to the police in protecting lives and property, and as a safety first precaution did much to prevent serious accidents on the roads.

The address was followed by a discussion by the members, many of whom are interested in municipal affairs.

On April 14th, P. Ackerman presented his paper entitled "Relay Protective Features of the Toronto Power Company's Transmission and Distribution System," which was published in the April issue of *The Journal.*

St. John Branch

Harry F. Bennett, A.M.E.I.C., Secretary-Treasurer

A public meeting of the St. John Branch was held in the Board of Trade Rooms on Thursday, March 31st. Invitations were extended to the members of the Board of Trade, the City Council, and the Association of Building and Construction Industries, all of whom were well represented at the meeting.

W. G. Chace, M.E.I.C., Vice-President of *The Institute,* and president of the Canada Lock Joint Pipe Co., Ltd., was the speaker, his subject being "Concrete Sewer and Water Pipe Construction." An added and very interesting feature of the lecture was the special motion pictures of work performed by this company, consisting of the manufacture and laying of 96 inch sewer pipe and 48 inch water pipe in the United States.

Mr. Chace spoke of the early water systems used by ancient peoples, of their use of free flow methods and also of a form of lead pipe for the carrying of water under pressure. Evidence of these methods were brought to light by those who were working in Eastern countries, and, in fact, some of these ancient systems were being used again.

In this country the use of reinforced concrete pipe for water supply was a very recent idea. It was for the purpose of eliminating the disadvantages of cast iron and wood stave pipe that his company had investigated and developed the lock joint reinforced concrete pipe which they had manufactured in large sizes. Their system of manufacture, as shown by the pictures, insured durability and the patented joint gave ample room for expansion, or allowed for any slight settlement which might occur.

The pictures showed in detail the manufacture of 48 inch pipe, the fabrication of the reinforcement, the placing of the forms and the pouring of the concrete. Further pictures showed the finished pipe, its transportation, the site, and method used in connecting the pipe up in the trench. The labour saving devices in use by the company were credited to Mr. Nichols, general manager.

This company is undertaking the construction of a 36 inch main from Spruce Lake to West St. John. Part of the pipe has been cast and is ready for laying. The lock joint device consists of a spigot and bell with a lead pipe gasket in which is packed a filler of wicking. The pipe is forced together under considerable pressure, the lead pipe fitting a groove in both the bell and spigot. Work has been started again and it is the intention to lay the pipe as soon as conditions permit.

At the close of the address a vote of thanks to Mr. Chace was moved by Alex. Gray, M.E.I.C. and seconded by R. B. Emerson, of the Board of Trade. G. G. Murdoch, M.E.I.C., Chairman of the St. John Branch presided.

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The contract for clearing and grubbing the right of way, and constructing the footings for the towers for the transmission line from the Musquash Power Development plant to the sub-station at Fairville, near St. John, has been awarded to the Maritime Construction Company, the distance is approximately 13 miles.

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Concrete in Sea Water

In an effort to arrive at a definite conclusion as to the requirements of a concrete which will be permanent in the sea water of the North Atlantic coast of Canada, extensive tests have been carried on by the Dominion Public Works Department in St. John Harbour under Alex. Gray, M.E.I.C., with A. G. Tapley, A.M.E.I.C., in direct charge of the work.

At a meeting of the St. John Branch, held on April 21st, Mr. Tapley reported on the method of making the test blocks and their condition after being in the water during one winter. His report was fully illustrated by lantern slides of various concrete structures around St. John Harbour and "close up" views of the test blocks.

The object of these tests is "to determine the action of sea water on concrete specimens of wet and dry consistencies, of various proportions of ingredients and of different brands of cements, as well as the effect of fresh and salt water aggregates". Seventy-six blocks were made, twelve inches by fourteen inches in cross section and six feet long. These specimens were immersed in sea water in a place and at the elevations where they are subject to the same conditions as the dock walls of the harbour. The period of setting before placing in the water varied in the different specimens. Smaller cubes were also made and placed with the test blocks to allow of tensile and crushing tests at any time.

The cement used was of two brands, Canada Portland Cement and Super Cement. Sand was used from Lake Utopia, near St. George, N.B., and Negro Point. Some of the blocks were hand mixed and some machine mixed. An accurate record of the ingredients, mixing and curing was kept. A brass wire was embedded in each specimen and to this wire was attached a lead tag on which the specimen number and the mixture are stamped. All cement used has been tested at the testing laboratory for testing materials at the Department of Public Works, Ottawa.

While the time in which these blocks have been in the water is short, many of them have already shown signs of deterioration. This is especially true of those which were allowed to set in air for long periods. The blocks which were placed while green, are apparently in better condition. The super cement, generally, shows more rapid deterioration than the portland.

At the present stage of the experiments, Mr. Tapley advances the following conclusions:—

That the concrete exposed to alternate periods of immersion in sea water and exposure to air, is deteriorating most rapidly.

That concrete placed in sea water should have creosoted, watertight forms which remain on the work.

That the deterioration at construction joints is very marked.

That the blending of sands was more important than specifying that it should be clean, sharp and coarse.

The pictures shown were excellent. They showed concrete in St. John Harbour placed at various periods up to sixteen years ago, some of the older works being in better condition than the more recent.

At the conclusion of the paper a general discussion took place. F. G. Goodspeed, M.E.I.C., in moving a vote of thanks to the speaker dwelt on the fact that these tests were spoiling some of the pet theories which had been advanced. At the same time there were works on the coast of the Maritime Provinces where concrete was standing up and he hoped these experiments would be continued in order that we might learn the secret of permanent construction.

The thanks of the Branch was also extended to Mr. Gray, through whose efforts these tests were made possible.

Moncton Branch

M. J. Murphy, A.M.E.I.C., Secretary-Treasurer.

The Moncton Branch of *The Engineering Institute of Canada* held its monthly supper meeting in the Y.M.C.A. building. An excellent repast was served by the Ladies Auxiliary of the Y.M.C.A.

After supper interesting and instructive addresses were delivered by J. D. McBeath, M.E.I.C., asst. city engineer and R. G. Gage, M.E.I.C., signal and electrical engineer of Canadian National Railways.

Mr. McBeath spoke first and his subject dealt with street cleaning and the problems confronting city authorities to-day, in its relation to the wear and tear on paved streets. Mr. McBeath brought to light some very interesting points in connection with street cleaning.

Mr. Gage's address dealt with automatic block signalling, more particularly as applied to single track operation on steam roads. The main features and advantages of the absolute permissive block system were gone into and the benefits both from the viewpoint of safety and increased facility in train operation shown.

In addition to the above addresses, the members were entertained to two musical numbers rendered by Messrs. Jas. Whitelaw, A.M.E.I.C., and F. S. Wilkins. Both of these gentlemen sang with their customary taste and expression and were called on for encores. Major W. A. McKee presided at the piano in his usual efficient manner.

*

The regular monthly meeting was held in the City Hall on Thursday evening, April 7th, when W. G. Chace, M.E.I.C., Vice-President of *The Engineering Institute of Canada* and president of the Lock Joint Pipe Company Ltd., gave an interesting and highly instructive address on "The Manufacture and Application of Reinforced Concrete Pipe to Municipal Services". Mr. Chace illustrated his lecture with moving pictures. The speaker was formerly engineer in charge of the Greater Winnipeg Water Supply and is at present installing four miles of 36 inch pipe for the City of St. John, N.B. Mr. Chace discussed the advantages of reinforced concrete pipe over wood stave pipe for the larger sizes and described in detail the two joints used in connecting the separate lengths of pipe, viz: the corrugated copper band, and the lead pipe gasket joint.

The proportioning of the concrete, he said, was determined from tests of the aggregate to ensure maximum density. He pointed out that the concrete was more than ample to withstand crushing by the backfill when the pipe was empty and that the importance of securing waterproofness warranted the addition, in some cases, of a small percentage of finely puddled clay. Also, a mixture slightly wetter than would secure maximum strength, was used in order to guard against separation of the aggregate during pouring.

The pictures showed in detail the setting up of the reinforcement, and forms, transporting materials, mixing and placing of the concrete, curing and finishing the product. Other pictures showed the work of transporting the pipe from the manufacturing yard, excavating and laying. The speaker described the pictures as they came on the screen, so that, altogether a very comprehensive understanding of the work was obtained.

At the close of the lecture, the meeting was thrown open to questions and several of the members present asked questions regarding the durability of reinforced concrete pipe. The speaker replied to all questions in a lengthy manner and gave much valuable information to his audience.

A hearty vote of thanks was tendered Mr. Chace, moved by J. A. Ellis, seconded by H. J. Crudge, A.M.E.I.C.

In extending the vote of thanks, J. D. McBeath, Chairman of the meeting invited the speaker to address the Branch again at a later date, should it be possible for him to do so, as Mr. McBeath pointed out it was felt that the engineers present had gained much valuable knowledge.

Mr. Chace, in reply, stated he would be pleased to speak before Moncton Branch and impart any information which might be of benefit to them.

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Preliminary Notice

of Applications for Admission and for Transfer

19th April 1921

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in May, 1921.

FRASER S. KEITH, Secretary.

The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BALL—WILLIAM SPENCER, of Toronto, Ont. Born at Liverpool, England, Sept. 17th, 1885; Educ., 1st class British Board of Trade, 1910. 1st class cert., Ontario. 1st class cert., Sask.; 5 years ap'ticeship, David Rollo & Sons, shipbldrs. and engrs., Liverpool; 1906-10, junior engr., C.P.R.O.S. mail steamers; 1910-13, senior engr., Ellerman & Houston Lines of steamers; 1913-14, in charge of install'n of new machinery, power house, Saskatoon; 1914-19, overseas; 1919-20, boiler and engine design, Dominion Shipbldg. Co., Toronto; May 1920 to date, chief engr., Lever Bros. Ltd., Toronto.

References: G. O. Thorn, J. R. Montague, J. J. Traill, W. Harland, C. J. Mackenzie, A. G. Hill.

BEETHAM—HUGH STANLEY, of Dauphin, Man. Born at Leeds, England, July 11th, 1883; Educ., 2 years course, Leeds Univ. Board of Education, London, England, certificates for Applied Mechanics, mach. constrn. and drawing heat engines; 3 years ap'ticeship machinist work; 1 year 2 mos., asst. engr., design, dfting & engine testing; 3 years, asst. to mech. engr., also in charge of section of drawing office, British Westinghouse Electric & Mfg. Co. Ltd., Manchester, England; 2 years 9 mos., with I.C.S., London, England, personally responsible to chief engr., for textbooks on valve gears etc.; 9 mos. with Vickers Ltd., Barrow-in-Furness, England; 1 year 10 mos., with Jas. Ballantyne Co. Ltd., Winnipeg, in charge of install'n of steam heating plants etc.; 5 mos., asst. to chief engr., Olympia Hotel Co. Ltd., Winnipeg; 10 mos. with Strong-Scott Mfg. Co., Winnipeg; 1916-17, chief shop insp'r., 4.5 howitzer shells, Manitoba Bridge & Iron Works Ltd., Winnipeg; 2 years with the Many Mining Co. Shist Lake, The Pas, Man.; May 1919 to date, shop supt., J. R. Eagle Land Clearing & Machinery Co., Dauphin, Man.

References: T. R. Deacon, H. A. Mackay, H. Spreoger, T. T. Wilson, R. C. Robinson, T. W. Clarke, D. Smith.

BLAIR—ROBERT THOMSON, of Ottawa, Ont. Born at Glasgow, Scotland, Sept. 13th, 1884; Educ., C.E. course, Royal Technical College, Glasgow, 1909-11. 1919 (3 mos.), course in munic. engr'g., London Univ.; 1904-09, insp'r of works on constrn., Bengal & North Western Rly., India; 1911-13, rodman and topog'r. on prelim. and location surveys, G.T.P. Rly.; 1913-14, instr'man on bridge constrn., G.T.P.; 1914-15, instr'man on constrn., Pacific Great Eastern Rly.; 1915-19, overseas, Lieut., Can. Engrs.; June 1920 to date, junior engr., drainage divn., reclsm. service, Dept. of the Interior, Ottawa.

References: J. S. Tempest, G. F. Richan, G. F. Horsey, W. C. Warren, H. R. Cram, C. K. Brown.

BURGESS—JAMES ROY, of Toronto, Ont. Born at Havelock, Ont., April 19th, 1892; Educ., B.A.Sc., Univ. of Toronto, 1910; 1911-12, mill wright, Lake Superior Pulp & Paper Co., Sault Ste Marie, Ont.; 1912 (Sept.-Nov.), insp'r., steel rails, Algoma Steel Corpn., Sault Ste Marie, Ont.; 1912-13, mech. dftsman., gas engine design, Alberga Gas Engine Co., Buffalo, N.Y.; 1915 (Feb.-Sept.), munitions inspr.; 1915-16, heat treatment engr. and gen'l. mtce., A. Thompson Tool Co., Woodstock, Ont.; 1917 (Aug.-Dec.), and Jan. 1919 to Feb. 1920, travelling install'n expert, Eastern Ontario for Sharples Separator Co., Toronto; June 1920 to date, mech. supt., Staunton's Ltd., Toronto. Full charge of mtce. plant, including steam electric plant, etc.

References: C. D. Dean, J. M. Gibson, W. P. Dobson, M. B. Watson, T. R. Loudon, R. L. Dobbin.

CAGEORGE—NICHOLAS, of Lachine, Que. Born at Athens, Greece, Mar. 20th, 1886; Educ., Varvakis College, 1904; 1908-09, tool dftsman., Bresnaham Shoe Mach. Co., Lynn, Mass.; 1909-11, tool dftsman, Montreal Locomotive Works, Montreal; 1911-12, shop engr. in charge of constrn., Warden King Ltd., Montreal; 1912-14, struct'l dftsman., National Bridge Co. Ltd., Montreal; 1914-20, checker in struct'l drawing office, and from June 1920 to date, asst. engr. in charge of a squad of struct'l drawing office, Dominion Bridge Co., Lachine.

References: W. C. Thomson, F. P. Shearwood, D. C. Tennant, A. Peden, D. O. Wing.

CAILLOUX—LOUIS, of Montreal, Que. Born at Larochelle, France. May 7th, 1897; Educ., Passed exam. for entrance to Polytechnic School, 1914; 1912-18, gen. engr'g works for F. C. Laberge, C.E.; 1919 to date, gen. mech. engr'g. for A. Lamontagne, C.E., Montreal.

References: F. C. Laberge, J. Duchastel, C. C. Leluau, L. E. F. Fusey, F. E. V. Dowd.

CAMPBELL—ELLIOTT STIRLING, of Halifax, N.S. Born at Moncton, N.B., Sept. 25th, 1897; Educ., 2 years engr'g., Dalhousie Univ. 5 years night classes, N.S. Tech. Coll.; 1917, rodman and dftsman. on city survey. Also dftsman., rlys. divn., Halifax Ocean Terminals; 1918, Can. Engrs.; 1919, asst. on constrn., Halifax Power Co.; 1920 to date, res. engr., and at present dftsman, Prov. Highways Board of N.S.

References: W. A. Hendry, J. W. Roland, R. C. Moore, D. S. Wickwire, R. W. McColough, R. L. Nixon, R. McColl.

ERIKSEN—ERIK, of Toronto. Ont. Born at Lellchammer, Norway, Dec. 19th, 1883; Educ., Civil Engr., Trondhjem Univ., Norway, 1905; 1905-06, dftsman, Necla Iron Works, Brooklyn, New York; 1906-09, dftsman, struct'l steel detailing dept., American Bridge Co. and Berlin Constrn. Co., Conn., U.S.A.; 1909-11, dftsman and office engr., Nor. Pacific Rly. in North Dakota on 250 miles of constrn. work; 1911-13, dftsman and office engr. on constrn. with C.N.R. at Nipigon, Ont. Also rodman and bridge insp'r.; 1913-14, res. engr., in charge of constrn., etc., C.N.R., Simcoe, Ont.; 1915, dftsman and office engr., C.P.R. constrn.; 1916-17, dftsman, C.N.R., Toronto; 1917-20, chief dftsman and designing bridge engr., C.N.R. Eastern Lines, Toronto. At present struct'l dftsman, bridge dept., C.N.R. Eastern Lines, Toronto.

References: A. F. Stewart, H. T. Hazen, J. C. N. B. Krumm, J. R. Mackenzie, R. Ferguson.

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*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognised by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option Railway, Municipal, Hydraulic, Mechanical, Mining, or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits scientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

FAIRLIE—WILLIAM ALEXANDER, of Toronto, Ont. Born at Lansdowne, Ont., Feb. 17th, 1892; Educ., B.Sc., Queen's Univ., 1913; 1909 (May-Oct.), rodman, C.P.R., mtce. dept., Toronto; 1910 (May-Oct.), timekpr. and asst. supt., Muralt & Co., contractors for H.E.P.C. transmission line; 1911 (May-Oct.), transitman, Toronto hydro-electric system; 1912 (May-June), transitman, C.P.R. mtce. dept., Toronto; 1912 (June-Oct.), instr'man., N.T.C.Rly.; 1913 (May-Dec.), asst. engr., Sir John Jackson Ltd., on power survey at Rocky Rapids, Sask. River; 1914, partner, Morrison & Fairlie, Contractors and Engrs., Edmonton, Alta.; 1915-16, in charge of constrn. cyanide plant at Cobalt Reduction Co., Cobalt, later on engr'g. staff of above company; 1916-19, overseas, Lieut., R.N.V.R. Auxiliary Patrol; 1919 (May-Aug.), engr. for Jas. O. Heyworth, Chicago, contractors for reinforced concrete viaduct; 1919-20, mgr., The Building & Constrn. Co., Akron, Ohio, complete charge and general constrn. work; Aug. 1920 to date, engr. in rly. dept., H.E.P.C. of Ontario.

References: E. T. Agate, W. L. Malcolm, K. Weatherbe, A. H. Greenlces, H. Wykes.

FISHER—RICHARD JAMES, of Sydney, N.S. Born at West Bromwich, England, Sept. 30th, 1881; Educ., Universities of Sheffield and Birmingham, England; 1902-06, ap'tice, Providence Engine Works, dftsman., J. S. Roberts, Engrs., West Bromwich; 1906-10, dftsman. and field work, Cammel Land & Co., Sheffield. Designer, J. Summers & Sons, Rolling Mills, Chester, England; 1910-17, in charge of all drawing office work for blast furnace dept., Dominion Iron & Steel Co., Sydney, N.S. Also design of merchant mill in 1915; 1917 (Apr.-Oct.), special open hearth work for Armstrong Whitworth, Longueuil, Que.; Nov. 1917, in charge of all engr'g. work in connection with blast furnace dept., Dominion Iron & Steel Co., and from Dec. 1918 to date, chief dftsman for same company.

References: D. H. McDougall, G. D. Macdougall, C. M. Odell, A. W. McMaster, H. Longley, D. F. MacIsaac.

GOODWIN—EDWARD MANSEL CAREY, of Temiskaming, Que. Born at Baie Verte, N.B., May 8th, 1894; Educ., 2 years Applied Science, Univ. of Toronto, 1913 and 1919; 1912 (summer), rodman on constrn., Quebec & Saguenay Rly.; 1914-19, overseas., Lieut., C.M.M.G. Bridge; 1919 (summer), leveller, N.S. Highway Board; Sept. 1920 to date, instr'man Riordon Co. Ltd., mill constrn. and hydro-electric development.

References: G. L. Freeman, E. S. M. Lovelace, H. T. Routly, J. E. Pringle, A. L. Cummings, C. G. J. Luck.

HAY—WILLIAM IRVINE, of Montreal, Que. Born at Slamannan, Scotland, June 4th, 1888; Educ., 1902-09, Glasgow & West of Scotland Tech. College; 1902-08. ap'ticeship with The Fairfield Shipbldg. & Engr'g. Co. Ltd., Govan, Scotland; 1909, on the Technical Staff of the British Corpn. for the Survey & Registry of Shipping, design and constrn. of steel ships, etc.; 1914-17, design and constrn. of war and merchant vessels for the British Admiralty and British Ministry of Shipping; 1917-21, design and constrn. of vessels built in Canada for Imperial Munitions Board and Can. Govt. Dept. of Marine; At present principal surveyor, The British Corpn. for the Survey and Registry of Shipping.

References: J. T. Farmer, I. J. Tait, N. E. McClelland, H. R. McClelland, F. A. Combe.

HUGHSON—WILLIAM ROOKER, of Kingston, Ont. Born at Inverary, Ont., Oct. 7th, 1892; Educ., B.A. 1913, B.Sc. 1917, Queen's Univ.; 1917-19, overseas; 1919 (May-Nov.), field asst., Geol. Survey of Canada; 1920 (Feb.-Apr.), designing dftsman, mill constrn., Geo. H. Gillespie & Co. Ltd., Madoc, Ont.; 1920 (Apr.-Dec.), topog'l dftsman, H.E.P.C., Morrisburg; Dec. 1920 to date, computer for the H.E.P.C., St. Lawrence River investigations.

References: M. C. Hendry, S. Bowen, C. H. Mathewson, T. S. Scott, G. J. Smith.

JOHN—JOHN SAINT, of Wabana, Nfld. Born at Llantwit Vardre, South Wales, July 5th, 1890; Educ., 1906-08, evening classes Glamorgan County Tech. School. 3 years ap'ticeship, So. Wales Elec. Dist. Co. Ltd.; 1908-09, coal mining, Great Western Colliery Co. Ltd., So. Wales; 1909-12, shift engr., Covy Bros. Electric Power Plant, So. Wales; 1912-14, power plant operator, N.S. Steel & Coal Co. Ltd., Waban, Nfld.; 1914-16, overseas. Honourably discharged on account of a wound received in action; 1916 to date, efficiency engr., N.S. Steel & Coal Co. Ltd., Wabana, Nfld.

References: A. R. Chambera, D. Lewis, C. B. Archibald, F. R. Faulkner, J. B. Gilliatt.

JONES—SYDNEY STUART, of Montreal, Que. Born at Isle-of-Man, England, Jan. 31st, 1895; 1 year bldg. constrn. and interior finishing, Henry Morgan & Co. Ltd., Montreal; 1912 (Aug.-Dec.), rodman on constrn. & location, C.P.R.; 1912-13, asst. instr'man and dftsman on land surveys and bldg. layout, Montreal; 1913 (Oct.-Dec.), topog'r. and asst. leveller, rly. location, C.P.R., Guelph Jct. to Bolton; 1914-15, topog'r., leveller and asst. instr'man on location, etc., C.N.R. in N.B. and N.S.; 1915-19, overseas. 1915-18, instr'man rly. location and constrn.; 1918-19, Lieut. Instructor, R.G.A.; 1919-20, leveller and instr'man, rly. location and revision, C.N.R. in N.B. and N.S.; 1920 (Mar.-June), bldg. constrn. amd mtce., D.S.C.R., engr'g. branch, Montreal; 1920-21, instr'man on town layout and constrn., Temiskaming; At present, instr'man in charge survey of property and mine, North American Magnesite Co., near Calumet, Que.

References: J. Duchastel, D. Hillman, A. K. Grimmer, J. M. Millar, E. S. M. Lovelace, S. B. Wass.

KILPIN—NOEL LEGH SANGSTER, of Montreal, Que. Born at London, England, Dec. 19th, 1892; 3rd year student, McGill Univ., session 1914-15; 1910 (June-Sept.), on rly. survey, C.P.R.; 1910-11, tracer, Structural Steel Co.; 1912-13, asst. dftsman. and rodman on location survey, C.P.R.; 1913 (May-Sept.), dftsman. on location survey, Lake Superior Divn., C.P.R.; 1914 (May-Sept.) and 1915 (May-Aug.), dftsman. and outside supervision of concrete pile driving for Ambursen Hydraulic Constrh. Co. and Raymond Concrete Pile Co., Montreal; 1915-16, chemical and physical testing and inspection work for Robt. W. Hunt Co., Montreal; 4 mos. 1916, chem. testing, Curtiss & Harvey Co., Dragon, Que.; 1916-17, dftsman., engr'g. dept., Ross & Macdonald, Arch'ts., Montreal; 1917-19, R.F.C. & R.A.F. as tech. officer in England; 1919-20, asst. mech. engr., Ames Holden McCready Co., on erection of new factory, etc.; Aug. 1920 to date, mech. dftsman., Steel Company of Canada, Ltd.

References: J. B. Porter, H. M. MacKay, E. C. Kirkpatrick, J. L. Busfield, H. M. Jaquays.

KINNEAR—CLIFFORD RUTHERFORD, of Montreal, Que. Born at Halifax, N.S., Jan. 26th, 1882; Educ., Kings Collegiate School, 1901; 1902-03 (inc.), ap'tice, Harris & Horton, Halifax; 1 year dftsman, Halifax Electric Tramways Co.; 1904-06, asst. engr. in charge of lines, grades, special track design and mtce., lighting and power circuits, with above company; 1907-11, asst. to engr. of mtce. of way, Pittsburgh Rly. Co., asst. engr. on constrn., Pittsburgh & Washington Rly., res. engr. in charge of constrn., Black Diamond to Denora branch; 1912-18, asst. engr., Montreal Tramways Co. Ltd.; At present asst. engr., Canadian Steel Foundries Ltd., special track work design, etc.

References: R. M. Hannaford, W. M. Reid, A. T. Spencer, R. O. Sweezey, J. Grieve.

LEECH—JACK HAROLD, of Cedars, Que. Born at Weston-super-Mare, England, Jan. 11th, 1895; 1910 (Jan.-Oct.), blue print office, C.P.R.; 1910-11, rodman, prelim. survey, C.P.R.; 1911 (June-Dec.), operator on clearance car for eastern lines, C.P.R.; 1911-13, rodman on terminal work and constrn. survey, C.P.R.; 1913 to date, rodman, concrete insp'r., bridge insp'r., and instr'man, on canal and power house constrn., and at present instr'man and dfting for Cedars Mfg. & Power Co., Cedars, Que.

References: J. Ewing, J. O. Bonin, G. P. Hawley, R. M. Wilson, J. M. R. Fairbairn.

LEROUX—ALBERT, of Outremont. Que. Born at Cedars, Que., Feb. 14th, 1889; Educ., C.E., Polytechnic School, Laval, 1913; 1911 (summer), Phoenix Bridge Co.; 1912 (summer), on survey work for E. Desaulniers, C.E.; 1913-14, road dept., City of Montreal; 1914-16, Montreal Water Works, Aqueduct Enlargement; 1916 (Jan.-Aug.), sewer dept., City of Montreal; 1916-20, Montreal Water Works Dept.; May 1920 to date, with Montreal Water Board.

References: C. J. Desbaillets, F. E. Field, F. Y. Dorrance, W. Matheson, W. Dickson, J. A. Jette, J. A. Lalonde.

MacKAY-WHITE—ERIC WILLIAM, of Edmonton, Alta. Born at Aberdeen, Scotland, June 29th, 1883: Educ., Senior Cambridge Local Exam. 1st class Colliery Mgr. (British Home Office Exam.); 1899-1902, articled pupil with Jonah Davies & Son, Consltg. Engrs., England; 1903-04, asst. surveyor, Haunchwood Collieries, Nuneaton, England; 1905-10, surveyor and asst. mgr. with above; 1911-14, travelling, prospecting, etc., in Canada; 1914-19, overseas, Capt. Royal Engrs.; Not employed at present.

References: W. H. Hunt, L. R. Thomson, R. J. Gibb, S. R. Lamb, M. Polet.

MADGETT—CLARKE JOHN, of Welland, Ont. Born at Hamilton, Ont., June 27th, 1886; Educ., 1906-12, night course civil engr'g., Carnegie Tech. Schools, Pittsburgh, and Armour Inst., Chicago; 1901-05, detailer, Hamilton Bridge Works Co., Hamilton; 1905-06, detailer, Canada Foundry Co., Toronto; 1906-09, checker, Heyl & Patterson Co. & McClintic Marshall Co., Pittsburgh, and detailer, Riter Conley Mfg. Co., Pittsburgh; 1909-12, squad boss, Joseph T. Ryerson & son and Geo. W. Jackson Inc., Chicago; 1912-16, chief engr., Hamilton Steel Constrn. Co., Hamilton; 1916-17, checker and sales dept., Hamilton Bridge Works Co.; 1917-18, sales engr., Standard Steel Constrn. Co., Welland, Ont.; 1918-20, asst. mgr.. and 1920 to date mgr., with above company.

References: H. C. Baker, R. P. Johnson, J. A. McFarlane, R. L. Latham, J. G. Jack, E. H. Darling, J. H. Hooper, A. H. Harkness.

MARSHALL—IRVINE MEREDITH, of Kingston, Ont. Born at London, Ont., Aug. 19th, 1893; Graduating B.Sc., Queen's Univ. May 1921; 18 mos. prelim. development work for Gowganda Syndicate, Gowganda, Ont.; 2 years with Miller Lake O'Brien Mine; 1916-19, overseas. Capt., Can. Engrs. Awarded M.C.; 1920, asst. field geologist, geological survey with S. J. Schofield on economic geology of Portland Canal District; On graduation will take position as engr. with Iron Mountain Mining Co., Iron Mountain, Miss.

References: A. Macphail, W. P. Wilgar, T. S. Scott, F. D. Reid, H. C. Kennedy, M. W. Maxwell.

MAYES—FREDERICK LEONARD, of St. John, N.B. Born at St. John, Oct. 13th, 1896; Educ., 1 year Civil Engr'g., Univ. of N.B.; 1914-15, on gen. constrn. for G. G. Murdoch, St. John, N.B.; 1915-16, with N.B. Telephone Co.; 1916-19, overseas, Sgt., Can. Engr.; May 1920 to date, on gen. constrn. and surveying with G. G. Murdoch.

References: G. G. Murdoch, G. G. Hare, A. Gray, G. N. Hatfield, D. R. Smith, A. G. Tapley, H. F. Bennett.

McARTHUR—DUNCAN, of Montreal, Que. Born at Greenock, Scotland, April 1st, 1873; Educ., engr'g. subjects at Science and Arts Classes and at Royal College of Science, South Kensington, London; 1890-95, ap'ticeship in engr'g., Greenock Foundry Co.; 1895-98, engine dftsman, Greenock Foundry Co. and Wallsend Shipbldg. Co. Ltd.; 1898-1901, engr. at sea, 1st class B.O.T. Cert. 1901; 1901-03, ship dftsman., Scott & Co., Greenock; 1903-04, asst. to consltg. engr. and naval arch't., Mr. James Maxton, Belfast; 1904-05, surveyor to British Corpn. for the Survey & Registry of Shipping, Glasgow; 1906 to date, with British Corpn. Registry as follows:—1906-10, in charge of engr'g. work in Sunderland, Hartlepool and Middleboro, 1910-13, principal engr. surveyor in Italy, 1913-19, in charge of engr'g. on merchant and naval vessels at head office, Glasgow, 1920 to date, principal engr. surveyor for Canada.

References: J. T. Farmer, I. J. Tait, N. E. McClelland, H. R. McClelland, F. A. Combe.

McLEAN—ERNEST P., of Sydney, N.S. Born at Montague Bridge, May 17th, 1883; Educ., 1 year Queen's Univ., 1910-11; 1904-08, rodman, levelman, G.T.P. Ry.; 1908-09, surveying in Sydney, N.S.; 1912, N.S. Railway west of Edmington; 1912-17, various positions, prospecting, dredging propositions, etc.; 1917-18, C.E.F.; 1918 to date, engr'g. dept., Dominion Iron Steel & Coal Co., At present opening up an office surveying, consltg. and arch'l. drawing.

References: F. Moberly, F. H. Emra.

MEWS—JOHN COURTENAY, of Wabana, Nfld. Born at St. John's, Nfld., June 30th, 1896; 1911 (6 mos.), machine shop, N.S. Steel & Coal Co., 1912-15, survey staff, above company; 1915-16, with R.N.R. on active service; 1916-19, overseas. Sgt., Royal Nfld. Regt.; 1919 to date, dftsman., N.S. Steel & Coal Co., Wabana.

References: J. B. Gilliatt, C. B. Archibald, J. H. Morley, S. C. Mifflen, J. B. Petrie.

MURPHY—PATRICK T., of Bell Island, Nfld. Born at Bell Island, Oct. 28th, 1899; Educ., St. Bon's College, St. John's, Nfld.; 1916 to date, with Dominion Iron & Steel Co., Wabana Mine, Nfld. Surface and underground surveying. 3½ years instr'man, 7 mos. to date in charge of underground surveying, responsible to res. engr.

References: J. H. Morley, S. C. Mifflen, J. B. Petrie, J. B. Gilliatt, C. B. Archibald, J. J. McDougall.

MUNFORD—THOMAS ALBERT SPRAKE, of Toronto, Ont. Born at Crewkerne, Somerset, England, Aug. 16th, 1887; Educ., Oxford Local Cert.; 1910-14, mtce. engr'g., C.P.R.; 1914-19, overseas, instr'man on location and constrn., C.O.R.C.C.; 1919-21, instr'man, C.P.R.

References: B. Ripley, V. A. G. Dey, A. P. Walker, D. Hillman, F. W. Cooper.

SANDALL—ALBERT St. LAWRENCE, of Montreal, Que. Born at London, England, Aug. 9th, 1891; Educ., Electrical Course, N.S. Tech. College; 1911-12, radio operator, United Wireless Tel. Co. of America and Marconi Wireless Tel. Co. of America; 1912-17, asst. electrician and 1917-19, chief electrician, cable ship "Minia", Anglo-American Tel. Co., London, England. Engaged in submarine tel. cable laying, repairing, etc. Ship comm'nd by British Admiralty. For duration of war, Engr. Sub. Lt., R.N.R., H.M.S. Minia; Aug. 1919 to date, engr'g. inspection at Northern Electric Co., Montreal.

References: P. F. Sise, G. R. MacLeod, N. L. Morgan, A. J. Lawrence, H. M. Dibblee, J. D. Peart, J. D. Hathaway.

SMALLWOOD—FRANKLIN, of Sault Ste Marie, Ont. Born at Charlottetown, P.E.I., July 20th, 1878; 1896-99, ap'ticeship with Truro Foundry & Machine Co., coal and gold mining, etc.; 1899-1901, with Bruce Stewart & Co., Charlottetown, P.E.I.C. Marine Engrs.; 1901-06, dftsman, 1906-09, chief dftsman, Dominion Iron & Steel Co.; 1909-10, constrn. engr. in full charge of design and constrn. of a steel casting plant. Londonderry Iron & Mining Co., Londonderry, N.S.; 1910-12, designer, Canada Foundry Co., Toronto; 1912-15, designer, 1915-17, asst. chief engr., Algoma Steel Corpn., Sault Ste Marie; 1917 to date, chief engr., with above corpn.

References: G. H. Duggan, D. H. McDougall, G. D. Macdougall, J. S. H. Wurtele, C. H. Marrs.

SMITH—ARTHUR ALBERT, of Toronto, Ont. Born at Loughborough, England, Feb. 27th, 1879; 1897-1900, articled to A. W. Cross, Borough Engr., Kings Norton Council, Birmingham, England; 1900-02, asst. engr. to Kings Norton Council; 1902-05, asst. engr. in charge of surveys for C. H. Gadsby, Consltg. Engr., London, England; 1905-07, asst. res. engr., Burton & Ashley Rly., England; 1907-08, asst. engr. with J. S. White & Co., on constrn. of Glasgow to Dunbarton Light Rly.; 1908-10, asst. engr. with J. Mowlem & Sons on reconstrn. of London County Council Tramways; 1910-14, res. engr. with C.N.O. Rly. and Toronto Suburban Rly.; 1914-17, asst. engr., Dept. Public Highways, Ontario; 1917-19, res. engr. prov. highway, Toronto-Trenton; 1919 to date, divisional engr. in charge of constrn. of the prov. highway, East of Toronto.

References: W. A. McLean, G. Hogarth, E. T. Wilkie, H. T. Routly, H. W. D. Armstrong.

SMITH—JAMES NORMAN, of Toronto, Ont. Born at Toronto, Sept. 17th, 1868; Educ., special course in electricity, School of Science, Univ. of Toronto, 1883-86; 1887-1895, gen. supt. and elect'l engr., The Ball Electric Light Co., Toronto; 1896, asst. works engr., C.G.E. Co., Peterborough, 1897-1900, chief engr., United Electric Co., Toronto, 1901, mgr. and engr., Canadian Motors Ltd., Toronto; 1902-13, with Ross & Holgate and later R. A. Ross & Co., Montreal, designing steam, electric and water works plants, operating, reports, etc.; 1914-17, district insp'r. of fuses for Canada, Imperial Ministry of Munitions; 1918, deputy power controller at Niagara Falls, Ont., representing Sir Henry Drayton during fuel shortage; 1919 to date, Toronto Power Co., Toronto. Research Divn. Research engr. on oxygen, hydrogen and chlorine electrolytically produced and patents covering same.

References: R. A. Ross, F. G. Clark, A. W. Connor, W. J. Francis, J. C. Kemp.

STEVENSON—JAMES MacINTYRE, of Calgary, Alta. Born at Slamannan, Scotland, Dec. 30th, 1887; Educ., Senior cert., Glasgow and West Scotland Tech. College. Member Alta. Assn. of Arch'ts.; 1903-08, special course Glasgow and West of Scotland Tech. Coll. combined with service of articles with Henry Higgins, Arch't., Glasgow; 1908, asst., Andrew Scobie, Dunfermline; 1908-11, chief dftsman., J. M. Adam & Co., Pneumatic Engrs., Glasgow, mech. and struct'l. engr'g work; 1911-15, Gowler & Stevenson, Arch'ts., Calgary; 1915-18, overseas. Officer in charge of rly. constrn. and bridges; 1918 to date, resident arch't., Dominion Govt. for Prov. of Alta.

References: A. L. Ford, G. W. Craig, G. N. Houston, P. J. Jennings, F. K. Beach.

TALBOT—CHARLES, of London, Ont. Born at Township of Dorchester, Co. of Middlesex, Ont., July 15th, 1869; Educ., Matric. 1888; 1895-1901, asst. highway engr., Middlesex County; 1901 to date, county engr. for County of Middlesex.

References: J. A. Bell, F. A. Bell, G. A. McCubbin, H. A. Brazier, J. A. P. Marshall, W. A. McLean, A. M. Jackson.

THORNE—EDWARD L., Jr., of Halifax, N.S. Born at Dartmouth, N.S., Feb. 27th, 1886; Educ., B.Sc., N.S. Tech. College, 1910. 4 years engr'g. course, Dalhousie Univ.; 1910-11, designing under J. D. Whitmore, Regina, Sask., Install'n. of various sewage and water works; 1912, town engr., Rouleau, Sask.; 1913, asst. engr., New Pier No. 2, Halifax; 1913-16, asst. engr., Halifax Ocean Terminals; 1916, supt., constrn. new gas works, car barns and coal storage, N.S. Tramway and Power Co., Halifax; 1917, supt. bldg. constrn., New Glasgow, N.S.; 1918, supt., devasted area, Halifax, N.S.; 1919 to date, gen. supt., Halifax, Relief Commission, Halifax.

References: A. F. Dyer, W. P. Morrison, H. W. L. Doane, J. L. Allan, W. A. Hendry, I. P. MacNab.

TREDCROFT—ERNEST HENRY, of Kamloops, B.C. Born at Bury St. Edmunds, England, Sept. 3rd, 1889; Member Assn. of Prof. Engrs. of the Prov. of B.C.; 1907-09, rodman and levelman on surveys in B.C.; 1909-11, transitman in charge of survey parties in B.C. and Calif.; 1911-13, transitman and asst. engr., B.C. Electric Rly., on constrn. of hydro-electric development at Lake Buntzen, B.C.; 1913-15 and 1919-20, asst. engr., Dominion Water Power Branch; 1915-19, overseas; At present, acting divn. engr., Dominion Water Power Branch, Dept. of the Interior, Kamloops.

References: R. G. Swan, C. G. Cline, A. W. Phillips, C. Varcoe, C. E. Webb.

WELLWOOD—HENRY, of Toronto, Ont. Born at Kingston, Ont., Nov. 4th, 1880; 1900-01, Bay of Quinte Rly.; 1901-02, topog'r., Central Ont. Rly.; 1902-03, instr'man on constrn., C.P.R.; 1903-06, in charge of survey party on prelim. and location, C.P.R.; 1906-13, dist. engr. in charge of constrn., C.P.R.; 1913-15, divn. engr., constrn., C.P.R.; 1915-19, overseas. Major, Can. Engrs.; 1920 to date, Grand Trunk Arbitration.

References: J. M. R. Fairbairn, J. G. Sullivan, R. A. C. Henry, M. A. Fullington, F. W. Cooper, J. M. Silliman.

WESTON—BENJAMIN THOMAS, of Temiskaming, Que. Born at Madison, Me., U.S.A., Nov. 28th, 1877; Educ., Civil Engr'g., Univ. of Maine, 1900; Member, Amer. Soc. Civil Engrs.; 1900-03, instr'man and dftsman with H. S. Ferguson, on paper mill constrn.; 1903-04, struct'l steel details, mill bldg. and bridge work; 1904 (Jan.-July), estimating, Cambria Steel Co.; 1904-06, estimating, detailing and designing on struct'l steel bridge and bldg. work; 1906-07, with W. G. Fargo, Jackson, Mich., on prelim. surveys and investigations for water power developments, etc., and red. engr. in charge of constn. on a dam and power plant at Croton, Mich.; 1907-08, concrete constrn. work, Seattle, Wash.; 1908 (Jan.-June), field engr. on constrn. of bridge piers and abutments near Missoula, Montana; 1908-13, with W. G. Fargo, Jackson, Mich., on topog'l surveys and from Sept. 1909, res. engr. in charge of constrn.; 1914-20, with H. S. Ferguson of New York, as engr. in charge of constrn. work; Jan. 1920 to date, res. engr., Riordon Co. Ltd., Temiskaming.

References: W. L. Ketchem, F. O. White, A. K. Grimmer, G. L. Freeman, J. E. Pringle, W. S. Lea, R. F. Davy, J. H. Irvine, W. S. Lockhart.

WOOLLAM—ARTHUR EDWARD, of Mattawa, Ont. Born at Montreal, Que., June 2nd, 1890; 1910-12, dftsman and checker, struct'l steel dept., Dom. Bridge Co., Montreal; 1912-14, bridge insp'r. and dftsman, C.P.R., Montreal; 1914-15, bridge insp'r. and dftsman, C.G. Rlys., Moncton; 1915-18, checker, struct'l steel and plant dept., Dom. Bridge Co., Montreal; 1919-20, asst. squad boss, struct'l steel dept., and asst. to local erection engr., Dom. Bridge Co., Montreal; 1920-21, squad boss, engr'g. dept., Riordon Co. Ltd., Mattawa, Ont.; (3 mos., bridge design, W. J. Francis Co., Montreal, 1916).

References: G. L. Freeman, P. B. Motley, W. J. Francis, F. P. Shearwood, D. C. Tennant, A. R. Ketterson, A. Peden, Jr., W. A. Duff.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

ANTONISEN—JOACHIM, of Port Arthur, Ont. Born at Christiana, Norway, Feb. 24th, 1869; Educ., 4 years Univ. of Dresden, Saxony, 1894-98; 1891-94, practical experience in United States as rodman and instr'man under several civil engrs. and surveyors; 1898-1900, asst. engr. with the Saxon Govt. Rlys., on location and constrn. work; in 1900, appointed asst. engr., dept. of road building and river improvement and employed in this dept. until 1904: 1904-05, transitman and terminal engr., C.P.R. Winnipeg; 1905-11, City Engr., Port Arthur, also mgr. of all public utilities from 1910-11; 1911 (July-Dec.), private work; 1912-13, city engr., Moose Jaw, Sask.; 1913-14, supt. of munic. electric rly. in Brandon, Man.; 1914-20, assessor, tax collector and engr. for munic. of Schuniah, Port Arthur. Also private work, railroad yard constrn. and elevator constrn. work; April 1920 to date, city engr., Port Arthur.

References: W. J. Francis, F. B. Brown, L. M. Jones, H. G. Acres, J. A. Hesketh, F. Lee.

CHARLES—HAVELOCK H., of Culver, Minn., U.S.A. Born at Dundas, Ont., July 25th, 1882; Educ., one year Univ. of Toronto; 1900-02, rodman, timekpr. etc., Can. Copper Co.; 1902-03, rodman, instr'man, C.N.R.; 1903-04, res. engr., C.N.R.; 1904-05, in charge of location, Can. Copper Co.; 1905-07, instr'man, Trent Canal and N.T.C. Rly.; 1907-09, res. engr., C.P.R. constrn.; 1909-11, res. engr., N.T.C. Rly.; 1911-15, dist. engr., C.P.R.; 1915-20, overseas. Enlisted as sapper, promoted to Acting-Major; Feb. 1920 to date, divn. engr., constrn., highway dept., St. Louis County, also charge of location.

References: C. W. P. Ramsey, C. Flint, F. R. Wilford, C. T. DeLamere, J. G. Reid, D. Hillman, C. L. Hervey.

KLINGNER—LOUIS WILLIAM, of Bagdad, Mesopotamia. Born at Toronto, June 10th, 1886; Educ., Grad. in engr'g. Univ. of Toronto, 1907; 1907-09, field dftsman, C.P.R.; 1909-10, designer of masonry work for the Grand Central Terminal of N.Y.C. Ry., Supt. of constrn. for The Foundation Co. Ltd., of Montreal and New York; 1910-11, supt. of constrn. and in sole charge of 4 reinforced concrete oil tanks for the Queen City Oil Co., Toronto. Asst. to the supt. on pneumatic caisson foundations for the Dominion Express Bldg., Montreal; 1914-19, overseas. Can. Engrs., Capt., Awarded M.C.; 1919, with The International Corpn. of Canada, Montreal; At present dist. irrig. officer, special projects, Bagdad, Mesopotamia.

References: T. K. Thomson, C. Luscombe, E. A. James, P. Gillespie, F. S. Darling.

McCLELLAND—HAROLD ROBINSON, of Montreal, Que. Born at Ballymena, Ireland, Sept. 21st, 1884; Educ., Undergrad., Royal Univ. of Ireland. Various courses, Glasgow Technical College. British Board of Trade Cert. as Chief Engr. Member of the following:—Instn. of Naval Arch'ts., London, Inst. of Marine Engrs., London, Soc. of Naval Arch'ts. & Marine Engrs., New York; 1902-07, ap'tice. John Lang & Sons, Johnstone, and The Fairfield Shipbldg. & Engr'g. Co., Govan., 4 mos. 1907 as dftsman with latter company; 1907-11, engr. in charge of watch at sea, Clan Line Steamers Ltd.; 1911-14, yard mgr., Elderslie Graving Dock & Repair Works, Glasgow; 1914-18, hull and engr. surveyor to Lloyd's Register of Shipping. Now engaged as consulting engr. to Halifax Shipyards Ltd. and subsidaries. Retained by Can. Govt. as ship expert on Grand Trunk Arbitration now proceeding. Vice-Pres. and Gen. Mgr., N. E. McClelland & Co. Ltd., Naval Arch'ts., Consltg. Marine Engrs. and Surveyors, Montreal.

References: J. T. Farmer, F. A. Combe, I. J. Tait, A. J. Grant, R. A. C. Henry, F. T. Peacock, A. G. Robb, A. Hutchison.

RUTLEDGE—LEWIS TRAVER, of Kingston, Ont. Born near Glen Williams, Ont., Jan. 18th, 1883; Educ., B.A.Sc., Univ. of Toronto, 1909; 1905-06, mech. elect'l. work, constrn.; 1907 (5 mos.), transitman, township surveys and railroad location; 1910 (summer), acting asst. to supt. of mainland branches, B.C. Electric Rly.; Sessions 1910-16, demonstrator in engr'g. faculty, Univ. of Toronto; 1910-16, lecturer in electricity, Toronto Tech. School evening classes; 1908-09 (10 mos.), with De Morest & Stull, Sudbury, in charge of survey and constrn. of Sudbury and Sault Trunk Road; 1911 (5 mos.), in charge of power development, Healey Falls, for Smith Kerry & Chace; 1912-13 (10 mos.), constrn. engr. Toronto Rly. Co.; 1915-20, chief mech. engr. and gen. mgr., Excelsior Electric Mfg. Co. Ltd.; At present asst. professor of mech. engr'g., Queen's University, Kingston.

References: L. M. Arkley, W. P. Wilgar, A. Macphail, P. Gillespie, C. R. Young.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

BACON—THOMAS HAMILTON, of Arnprior, Ont. Born at Montreal, Que., Sept. 8th, 1889; Educ., B.Sc., McGill Univ. 1911; 1911-15, engr. designing reinforced concrete etc., Montreal office, National Fireproofing Co. of Canada, Ltd.; 1915-19, overseas. 1918, appointed officer in charge Engr'g. Jura Group Hqrs. under command of Lt.-Col. G. H. Johnson, C.B.E.; 1919 to date, asst. engr., McLachlin Bros. Ltd., Arnprior, Ont.

References: J. W. Harkom, W. D. Staveley, C. G. Child, R. S. L. Wilson, J. H. Norris.

LITTLE—EDWARD CARUTHERS, of St. Margaret's Bay, N.S. Born at Ottawa, Ont., June 11th, 1893; Educ., B.Sc. (Civil), McGill Univ., 1915; 1910 (May-Sept.), rodman on constrn. Hawk Lake Section, Algoma Central Rly.; 1913-14 (summers), leveller in charge of party on the St. Lawrence Ship Canal surveys; 1915 (May-Nov.), engine ring clerk, town planning branch of the Comm'n. of Conservation; 1915-19, overseas. Lieut. C.F.A. Mentioned in despatches Nov. 1918. Awarded Croix de Guerre of Belgium; 1919-20, junior and asst. engr., No. 1 section, Welland Ship Canal; June 1920 to date, constrn. engr. for L. G. Loomis & Sons on the constrn. of St. Margaret's Bay Power Development.

References: W. H. Sullivan, J. W. LeB. Ross, J. White, G. R. Heckle, C. D. Sargent, K. H. Smith.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

HAYWARD—JOHN GRAY, of Hamilton, Ont. Born at Chicago, Ill., Sept. 21st, 1889; Educ., B.Sc., McGill Univ., 1912; 1907-12, erecting, testing, operating and mtce. of gasoline and oil engines during vacations. C.P.R. Angus shops, Montreal. Canadian Fairbanks Morse shops, Toronto; 1914, with Russell Motor Car Co., Toronto; 1914-15, with Fetherstonhaugh & Co., Toronto and Hamilton offices; 1915-19, overseas. In charge of various mech. transport units and repair shops; At present resident mgr. for Fetherstonhaugh & Co., Hamilton Branch.

References: W. H. Breithaupt, R. J. Durley, H. H. Vaughan, C. M. McKergow, E. P. Fetherstonhaugh.

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Surge Protection on Transmission Lines and Cables

Discussion of Problems with special reference to Surge Protection used by Montreal Light, Heat and Power Consolidated.

S. Cunha and G. C. Read

Paper read before Montreal Branch, The Engineering Institute of Canada, March 10th, 1921.

The subject "Surge Protection" needs no introduction, as it constitutes one of the most important problems in electrical engineering.

In 1914-15 the M. L. H. & P. Coy's System was subjected to voltage disturbances of a very serious nature; the object of this paper is to outline the curative methods adopted and the results obtained therefrom.

General Outline of System

The Company operates four hydraulic plants, one steam station for emergency use, and purchases from the Shawinigan Water and Power Company a considerable block of power. Power is delivered to Montreal,—on the east side at Orleans Avenue from the Shawinigan Water and Power Company; near the centre of distribution at Queen St., from Chambly; and on the west side of the City at Cote St. Paul and LaSalle, from Lachine, Cedars and Soulanges Plants.

These several stations and other distributing stations where the power is stepped down through transformers, are connected by a network of approximately eighty miles of 12000-volt underground cable and 76 miles of 12000-volt overhead tie and distribution lines.

The protection against disturbances on the system at the time previously cited covered the main transmission and distributing lines. The Shawinigan and Cedars lines were equipped with aluminum arresters at both ends. The Chambly lines had multigap arresters at both ends and horn gap arresters with concrete resistances in series at the power plant end. The other distributing lines were equipped with horn gap arresters. At the present time, the protection on the main transmission lines remains the same, series resistances have been added to the horn gap arresters on the aerial distributing lines and over-voltage protection provided for at the sub-station bus bars. In the present paper we shall confine ourselves to the discussion of the added protection to the aerial lines and underground cables (12000-V, 3-phase).

The frequency of disturbances originating in our system is problematical. The natural frequency of our overhead lines is in the neighbourhood of 50,000 cycles, and about 20,000 cycles for the cable system. Frequencies of a much higher order are to be expected in disturbances caused by lightning or switching.

Dr. Steinmetz has recently shown that moderately high frequency disturbances may travel considerable distances without losing much of their effectiveness, and as an illustration, he cites the case of a 60,000 cycle wave retaining 70% of its amplitude or about 50% of its energy after having travelled over 62 miles.* Under these circumstances some energy absorbing device is necessary, the type depending largely on local conditions.

Aerial Line Protection

(a) It is generally recognized that horn gap arresters without series resistances are a menace and a source of danger, for when the gaps across two or more horns discharge simultaneously, a dead short circuit occurs and may be of sufficient severity to throw synchronous apparatus out of step.

For low frequency disturbances, the resistance is usually made equal to or greater than $2\sqrt{\frac{L}{C}}$, this value corresponds to the "critical resistance" in the case of a condenser discharging into an inductive circuit. A much smaller value of resistance may be used. Steinmetz has shown that the danger from oscillations may be eliminated by using a resistance equal to $.4\sqrt{\frac{L}{C}}$ *

For high frequency disturbances the resistance should be made equal to or greater than $\sqrt{\frac{L}{C}}$, in the former case, the whole of the energy is absorbed by the resistance. Reference will be made to this point later on in the paper.

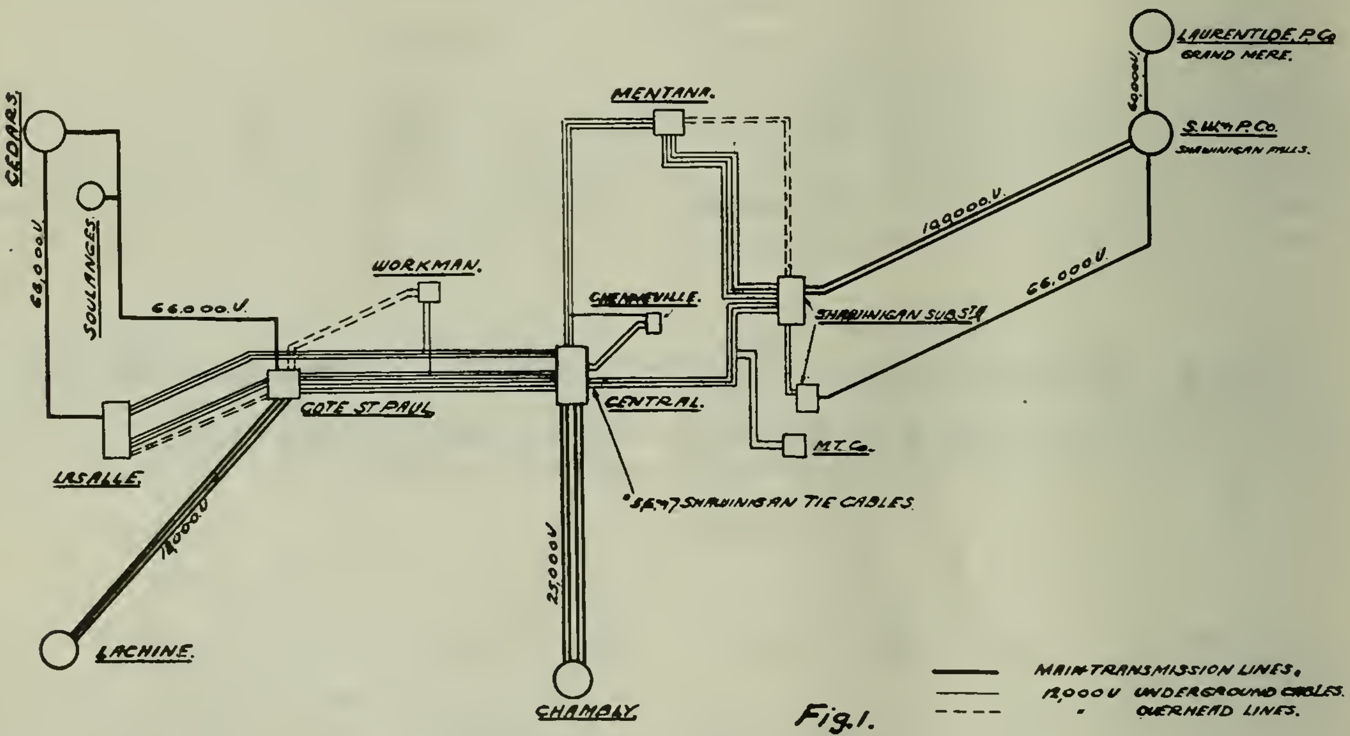

Fig. 1.

Shows the general layout of the system.

Previous to the installation of series resistances, the horn gap arresters at Lachine Power House were frequently short-circuited, by swarms of shad flies, this invariably caused an interruption of service.

Horn gap arresters with resistances should be used only on moderate voltage systems, because the sudden rupturing of the arc due to air currents or other causes may involve high potentials and thus result in trouble of a far greater magnitude than the original spark.

The value of the series resistance depends on the nature of the disturbance and on several other factors, for instance, the resistance should not be too low, in which case the discharge current may be excessive.

The term $\sqrt{\frac{L}{C}}$ is called the surge impedance and has a value of about 270 for our overhead lines; the series resistances on the system are about 600 ohms each. The concrete resistances on the Chambly lines are about 250 ohms each.

The gap setting corresponds to 18,000-V under weather conditions. With such small gap settings the horns have practically the same characteristics as spheres, for the reason that the gap is practically equal to the diameter of the horn. On the other hand, the sphere gap is much inferior to the horn gap where heavy dynamic currents are involved.

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*Steinmetz. Transient Electric Phenomena and Oscillations (3rd Edition), p. 563.

*Steinmetz. Transient Electric Phenomena, p. 66 (3rd Edition.)

The horns used on our system are constructed of 4/0 copper and are mounted on revolving insulators; disconnecting mechanisms are also provided for opening the gaps.

(b) Choke Coils;

The introduction of inductance, such as a choke coil in a line affords no protection to low frequency surges, but is invaluable as a protection against high frequency disturbances or steep wave fronts. The high frequency wave on meeting the inductance is reflected back into the line,—it thus delays the progress of the surge allowing sufficient time for the spark gap to be ionized and giving the arrester more time to discharge.

If the disturbances originate in the apparatus to be protected, then the choke coil is a source of danger, because the high frequency waves are reflected back into the apparatus and by their cumulative effect, due to internal resonance, may produce dangerous standing waves.

The essentials of a good choke coil from a standpoint of protection are as follows:

(1) Moderate inductance.
(2) Minimum capacity between turns.
(3) Adequate current carrying capacity at normal frequency.

The choke coils used by the Company are of hour glass type and consist of 20 turns of 4/0 copper and are mounted on suitable insulators. The inductance is approximately .00025 henry.

Bus-Bar and Cable Protection

(a) The cable protection consists of a condenser in series with a resistance connected permanently to the bus bars in all the sub-stations. (See figure 3). This device and several others were originated by the Italian engineer, Gina Campos.

Condensers have been extensively used in Europe for surge protection. (Figure 2). The condenser in itself offers no protection, as it is incapable of absorbing or dissipating energy in any appreciable quantities. For low frequency disturbances the condenser is valueless, but at high frequency conditions it offers a short-circuited path to ground.

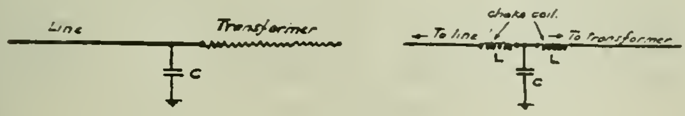
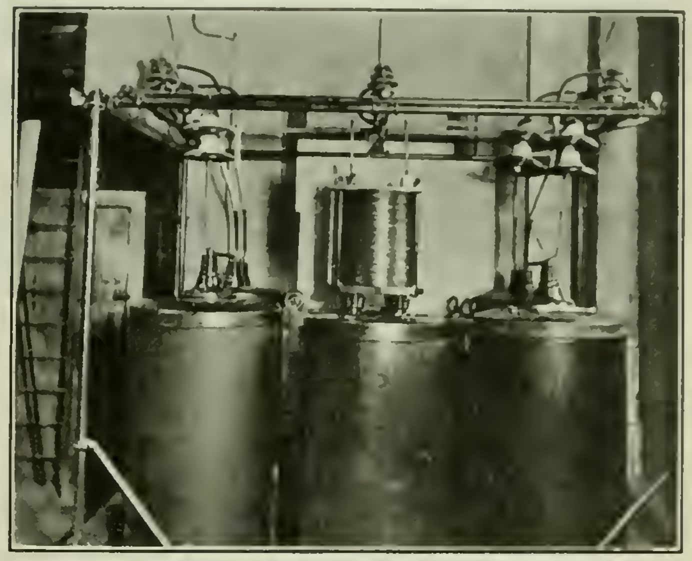


Fig 2

Disturbances of the latter nature on meeting a condenser are reflected back into the line and a local drop of potential exists in its immediate neighbourhood. The initial steep waves are thus considerably smoothed out.

The condenser resistance arrangement has similar characteristics at high frequencies, it is also capable of absorbing energy, and in this respect is superior to the condenser alone.

In a series of extensive tests carried out by the General Electric Company in Pittsfield, it was shown that good protection against high frequency surges at 100,000 cycles was afforded by a capacity of .005 m.f. in series with resistance of about 1000 ohms. Somewhat better results were obtained with a larger capacity of .01 m.f. and a smaller resistance of about 500 ohms.



View showing Condenser, Indoor Installation

Condensers of .007 m.f. each and resistances of 600 ohms each are used on our system.

The impedance of a condenser and resistance in series is given by $Z=\sqrt{R^2+\frac{1}{(2\pi fc)^2}}$ ohms.

R = resistance in ohms. C = CAP. in mfds.

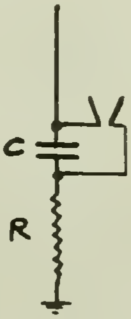


Fig 3.

Assuming the values for C and R given for our system we find that at 60 cycles the current per phase is .018 amp. at 6,930 volts to neutral, the impedance is 380,000 ohms, and the energy dissipated is .2 watt seconds. At 100,000 cycles the current per phase is 10.8 amps., the impedance 642 ohms, and the energy absorbed is 70 K.W. seconds. (The effects of energy absorbtion in the dielectric material of the condenser, uneven current distribution and temperature variations in the resistance are neglected in the above calculations.)

It is thus seen that the condenser resistance arrangement or surge absorber acts as a valve allowing only high frequency currents to pass.

In order to make the combination effective for low frequency disturbances, the condenser is shunted by a horn gap, (See figure 3), for with low frequency disturbances the drop of potential across the condenser is sufficiently high to cause the gap to discharge, the current is thus by-passed into the resistance to ground. The gap setting corresponds to 15,000 volts.

If one line of the three phase system is grounded the absorbers on the ungrounded phases are subjected to 1.73 times normal voltage, or in other words, to line voltage. The effects of a resistance ground on a cable protected by surge absorbers are shown by the curves in Figures 4 and 5.

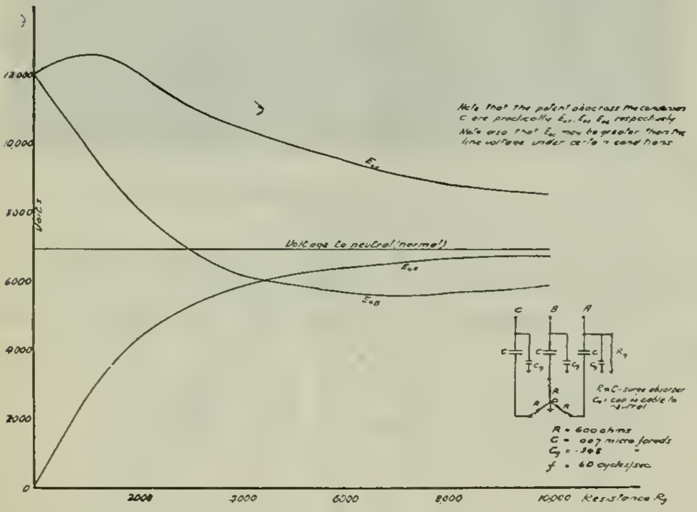


Figure 4

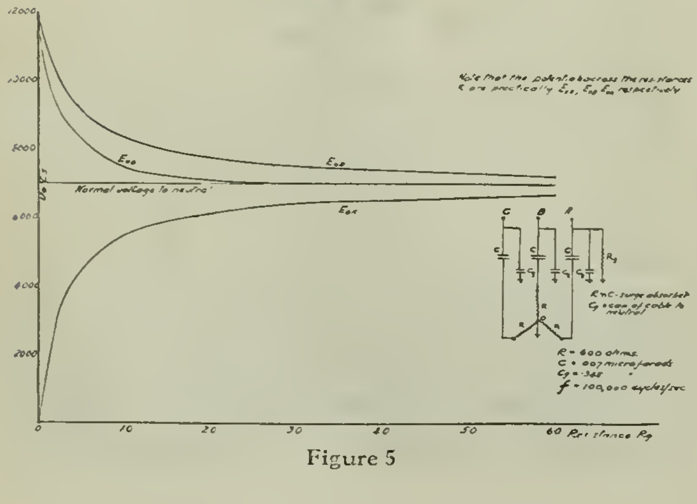


Figure 5

The curves are only approximate and are based on the assumption that the neutral of the supply generator is fixed, wave distortion due to higher harmonics is neglected.

In the case of an arcing ground the voltage across the absorbers may rise to two or three times the values shown.

(b) Condensers:

The condensers are constructed of circular steel plates for the active material and solid oiled press board in the form of circular sheets for the dielectric. The complete unit is oil immersed in a round steel tank provided with suitable bushings.

(c) Resistances:

The resistance consists of four unit frames made of oil treated maple, each frame carrying four independent windings of 150 ohms each.

The resistance conductor is nichrome and of rectangular section. The complete unit is immersed in about 100 gals. of oil.

In view of the fact that the resistances may be subjected to line voltage, the current carrying capacity of the conductor is liberally rated. The load time performance is as follows:

14.5 amp. for five minutes, 20 amp. for 2-2/3 min., 40 amp. for 40 sec. without exceeding a 60°C rise of oil temperature; as rapid circulation is necessary for effective cooling, a special oil having low viscosity is used. The same type of resistance is used for both cable and overhead line protection.

Operating Data

In eight years from January 1912 to December 1920, there were 71 cable burnouts in the joints and 25 in the stretches. About 25% of the cable failures in the stretches are due either to accidents, such as bursting water mains, electrolysis, or broken ducts.

The cable failures in stretches and joints increased from 6 in 1914 to 23 in 1916. This may be laid to several conditions, (i) 45% more cable was installed and the weak joints were broken down during this year. (ii). Considerably more power was added to the system when Cedars began operating, thus affording greater opportunity for disturbances to be set up. (iii). The surge absorbers were not completely installed till late in 1916.

In 1917 the number of burnouts dropped to 11; in 1918 to 8; in 1919 to 10; in 1920 to 11. In the past year several of these failures were due to unavoidable overload.

The interruptions to service were probably more serious in the months of June, July and August of 1915, than at any other date. If we designate the number of interruptions as 100% in these three months, the interruptions to service in the same months of 1919 are 5.3% and for 1920 are 9.7%.

There have been a few cases of very severe disturbances in which these surge absorbers have to relieve the system. On September 6th, 1919, there occurred, perhaps, one of the worst disturbances which the system has experienced since 1916. In the morning at 7:30, .9:06 and at 4:13 p.m., the horns on the surge absorbers in Mentana and Central Stations arced over. At 5:22 p.m. a heavy short occurred on the system by No. 5 Shawinigan tie cable failing. The horns on the absorbers at Mentana discharged for about 30 seconds, the arc on one of the horns was blown to ground, one of the windows near the horns being open at the time, the arc jumping 43½ in. to ground. This disturbance travelled through the system to Lachine Power House, destroying one pole of the oil switch on the 12,000-volt side of the transformers. It also burned the high voltage end coil of one of the transformers and short circuited one of the low voltage coils.

The system was thus subjected to two arcing grounds, one as noted and the other on the defective cable, the absorbers in the other stations arced over, thus relieving the system. From our previous experience with surges of this nature, the damage done was relatively slight, in as much as it was confined to one station only.

The following observations may be of interest:

(1). Lightning storms rarely cause the absorbers to discharge. The aluminum arresters on the main transmission lines appear to take up any surges of this nature.

(2). The same applies to ordinary short circuits, grounds, etc., on the transmission lines, except in the case of severe short circuits near the city limits.

(3). Defective insulators, choke coils, and arcing grounds generally, on the overhead (12,000-V) lines, will cause discharges until the line finally breaks down. This usually occurs shortly after lightning storms.

(4). Defective cable joints usually cause discharges for several days previous to the final breakdown.

(5). Generally speaking, switching operations performed in the sub-stations, do not cause the absorbers to discharge. It has been observed, however, that a shut-down involving the separation of the various plants and the subsequent re-distribution of the load, etc., discharges occur in the course of an hour or so later due to no apparent cause.

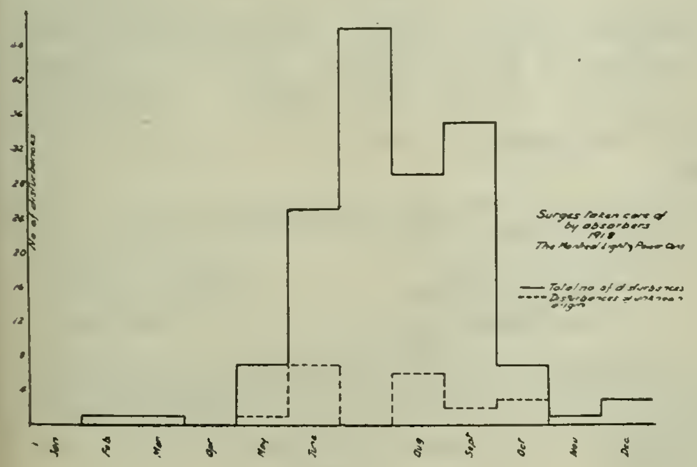


Figure 6

In several cases it has been noted that the opening of the switches at Montreal Tramway Company, at Hochelaga, has caused the absorbers to discharge at Mentana Sub-Station.

Switching operations at Lachine Power House involving the synchronizing or disconnecting generators, have caused discharges at Mentana and occasionally at Central Station. Similar operations at Chambly occasionally cause discharges at Mentana.

(6) The charging of the aluminum arresters at both ends of the Cedars line will cause, under favorable conditions, discharges at both Mentana and Central Stations.

(7) At Mentana high frequency surges have been taken care of, for instance, the opening or closing of tie feeder switches or the switches connecting the absorbers to the bus bar.*

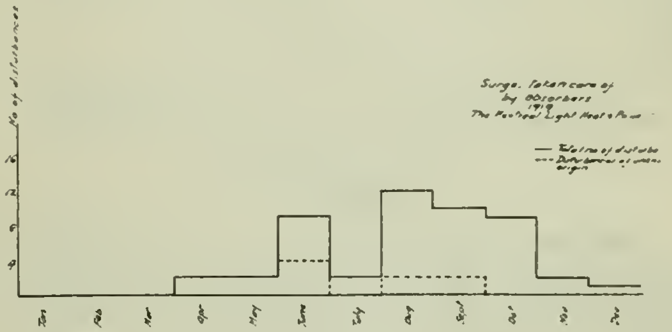


Figure 7

Curves 6, 7 and 8 show the number of disturbances taken care of by the absorbers for 1918-19-20.

Theory

In the study of transient electric phenonema it is necessary to distinguish between two classes:

(1) Disturbances propagated at a speed depending on the frequency of the supply.

(2) Disturbances propagated with extreme rapidity corresponding to the speed of light.

Disturbances of the first class are caused by the opening of circuits under load, rupturing of short circuits, arcing grounds, etc. The oscillations set up thereby are of relative low frequency and are not uncommonly associated with tremendous volumes of energy.

Disturbances of the second class are caused by switching, sudden voltage variations, etc., or by the introduction of electrical energy from an external source, such as lightning. The frequency ranges from a few thousand cycles to millions. Disturbances of the latter nature are harmless and manifest themselves in the form of "static". It is well known that static discharges deteriorate insulation by the production of heat and chemical disintegration, thus rendering conditions favourable for the production of low frequency surges.

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* Coherer discharge alarms are installed in this station.

Disturbances ranging from 20,000 to 100,000 cycles are often of a destructive nature due to local concentration or piling up of the voltage on the end turns of transformers, generators or other inductive portions of the circuit. These disturbances may be accompanied by excess or even low voltages,—the latter are of an exceedingly dangerous character and may cause, by reason of their high frequency, internal resonance between sections or group of sections in transformer windings; they occur chiefly on moderate voltage systems, on high tension lines they are rapidly dissipated due to skin effect, etc.

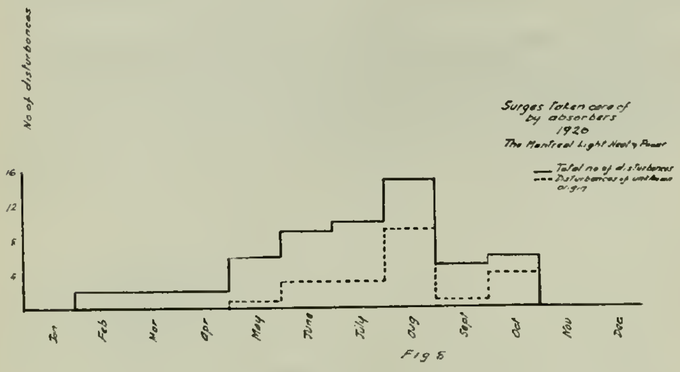


Figure 8

High frequency disturbances are of a similar character to the transient phenomena occurring in continuous current circuits; transfer of energy is involved and for this reason the transients are called "travelling waves". Problems of this nature are greatly simplified by assuming that the initial waves are rectangular, i.e. the wave front is perpendicular. As a matter of fact the wave front is sloped due to the uneven distribution of current in the conductors at high frequencies; furthermore, the waves on their journey are attenuated or thinned out according to the following law:

$$E = E_0 e^{-\theta t.}$$

$$\theta = \tfrac{1}{2}\left(\frac{R}{L} + \frac{G}{C}\right)$$

t the time.

Where R, L, C & G are the resistance, inductance, capacity and conductance per unit length of the circuit.

Theory of Travelling Waves

We now propose to give a brief theoretical outline of the more salient features involved in the phenomena connected with travelling waves, and with special reference to the protective apparatus previously described.

If a circuit containing inductance capacity, but of negligible resistance is suddenly opened, the discharge current alternates with decreasing intensity. It can be shown that when the voltage is zero the whole energy is stored in the magnetic field and is equal to $\tfrac{1}{2}L\,I^2$ where L is the inductance in henrys and I the maximum value of the current; when the current is zero the whole energy is stored in the dielectric field and is equal to $\tfrac{1}{2}E^2C$, where C is the capacity in farads and E the maximum value of the e.m.f. It is obvious that as long as the energy alternates from electrostatic to electromagnetic then

$$\tfrac{1}{2}L\,I^2 = \tfrac{1}{2}E^2C \qquad (1)$$

Actually the electrical energy is transformed by the resistance into heat and since this process is irreversible the oscillations gradually die down and finally vanish.

The rate of transfer of energy in cycles per sec. is called the natural period or frequency of the circuit, and is given by

$$f = \frac{1}{4\pi\sqrt{LC}} \qquad (2)$$

If the inductance and capacity are uniformly distributed then

$$f = \frac{1}{4\sqrt{LC}} \qquad (3)$$

From equation (1) we find $E = I\sqrt{\frac{L}{C}}$; the term $\sqrt{\frac{L}{C}}$ is called the "surge" or "wave impedance" of the circuit and may be defined as the proportionality factor between the voltage and current.

As a further illustration of the meaning of the term "surge impedance" let us consider a circuit containing uniformly distributed constants (resistance and leakage neglected), as shown in Figure 9.

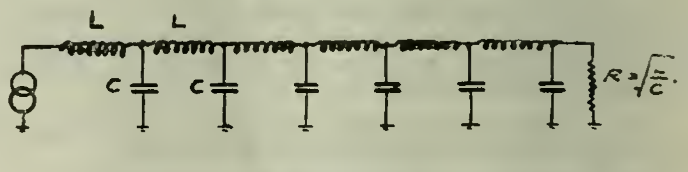


Fig. 9

If we close the circuit through an equivalent resistance equal to $R = \sqrt{\frac{L}{C}}$ i.e. the surge impedance of the circuit, then at any point the voltage and current bear a constant definite relation, or in other words, the deflection of a voltmeter connected across the lines at any point will be the same, as will an ammeter connected in any part of the line, — all the energy supplied is absorbed by the resistance. It will be shown later that if travelling waves are introduced in the circuit no reflection takes place.

The value of the surge impedances commonly met with are as follows:

Overhead lines	250 to 500 ohms
Underground lines	30 to 50 ohms
Transformers lines	3000 ohms

In the case of very high voltage power transformers, the surge impedance depends on the wave length. For further information see "Abnormal Voltages Within Transformers" by Blume & Boyajian. A.I.E.E. vol. XXXVIII.

Travelling electric waves may be reflected and refracted, and in this respect are analogous to light waves.* The phenomena of reflection and refraction are caused by changes of current and voltage due to change in surge impedance. It is, therefore, of the greatest importance to investigate the boundary conditions between two circuits of different surge impedances.

Before passing to the solution of this problem, we shall now give certain rules for guidance and review the elementary properties common to all electric travelling waves. (a) Waves travelling in a direction from left to right are positive, waves in the reverse direction are negative. It is, of course, understood that the sense of directions is purely arbitrary.

(b) In the positive direction the voltage and current waves are of the same sign; in the negative direction the voltage and current waves are of the opposite sign.

(c) The resultant of two waves passing each other is the numerical sum of their values at the passing point and on emergence the waves are unaltered. For instance if two equal and opposite waves of the same sign coincide the voltage is doubled and the current reduced to zero. Similarly, if the waves are of opposite sign the current doubles and the voltage zero,— in the former all the energy is stored in the dielectric filed and in the latter in the magnetic field.

(d) The phase angle between the voltage and current remain constant in the incident and reflected waves, respectively. Change in phase angle can occur only in the case of a resultant wave. The constancy of phase relation may be termed the characteristic of travelling waves; in the standing wave the voltage and current are in quadrature—no transfer of energy takes place. (e) The energy of the incident wave is equal to the energies in the transmitted and reflected waves; if at the transition point of two circuits some device is connected, then the energy stored or absorbed by same must be included.

(f) The changes occurring at the transition point of two circuits of different surge impedances: (see figure 10).

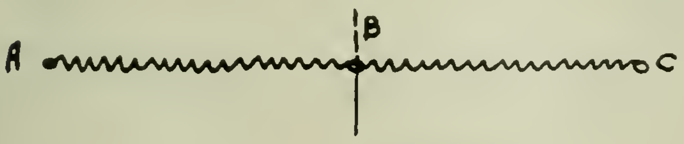


Fig 10

The wave on arriving at B splits into two parts, one is transmitted from B to C and the other reflected back from B to A.

The sum of the incident and reflected voltage waves is equal to the transmitted voltage wave.

i.e. $E_1 + E_2 = E_3$ (4) (where E_1, E_2 and E_3 are the incident, reflected and transmitted voltage waves, respectively.

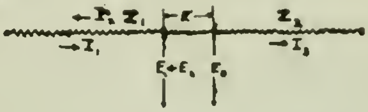
The difference of the incident and reflected current waves is equal to the transmitted current wave.

i.e. $I_1 - I_2 = I_3$ — (5) where I_1, I_2 and I_3 are the incident, reflected and transmitted current waves respectively.

A series or shunt device connected at the transition point necessitates certain modifications in equations (4) and (5).

For the sake of brevity the necessary changes are shown diagramatically below:

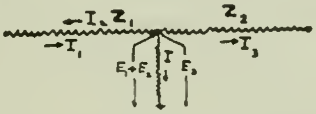
Series device:-



$E_1 + E_2 = E_3 + E$
$I_1 - I_2 = I_3$

Resistor $E = I_3 R$
Reactor $E = L \frac{dI_3}{dt}$
Capacitance $E = \frac{1}{C}\int_0^t I_3\,dt$

Shunt device:-



$E_1 + E_2 = E_3$
$I_1 - I_2 = I_3 + I$

Resistor. $E_3 = IR$
Reactor. $E_3 = L \frac{dI}{dt}$
Capacitance. $I = C \frac{dE_3}{dt}$

(g) Waves of finite length may be treated as the resultant of two equal and oppositely signed infinite waves displaced by a time equal to the duration of the finite wave. It is obvious that the wave fronts of both finite and infinite waves are the same.

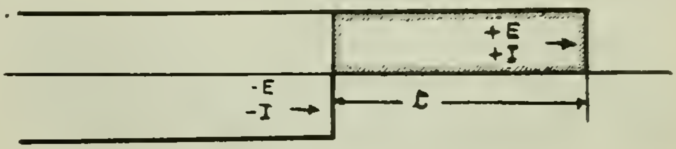


Fig 11

The wave in its passage along the circuit leaves a slender tail behind it due to variations in speed and attenuation. The process known as the "tailing of waves" is of a similar nature to diffusion problems in the theory of heat, and is one of extreme difficulty from a mathematical point of view.

In the rectangular wave of finite length the tail or rear may be found by superimposing the negative infinite wave from time $t = 0$ to $t = \infty$ on the positive infinite wave at time t. (See figure 11).

The reflected wave alone travels back from B to A (See figure 10), if the incident wave is of finite length, whereas, the incident and reflected waves combine if the former is of infinite length.

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* Electric and light waves differ only in wave length.

Let us now consider in detail the changes occurring at the transmission of two circuits of different surge impendances—from now on we shall assume the wave fronts are perpendicular, i.e., rectangular waves.

Referring to Figure 12 we may write to the following equations:

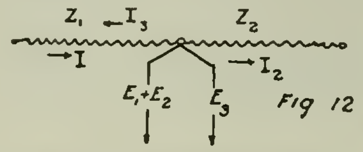


Fig 12

$$\left.\begin{aligned} E_1 &= I_1 Z_1 \\ E_2 &= I_2 Z_1 \\ E_3 &= I_3 Z_2 \end{aligned}\right\} - (6) \qquad \begin{aligned} E_1 + E_2 &= E_3 \quad - (4) \\ I_1 - I_2 &= I_3 \quad - (5) \end{aligned}$$

Combing (4) (5) & (6)

$$E_3 = 2E_1 \frac{Z_2}{Z_1 + Z_2} \quad -(7)$$

$$E_2 = 2E_1 \frac{Z_2 - Z_1}{Z_1 + Z_2} \quad -(8)$$

$$I_3 = 2I_1 \frac{Z_1}{Z_1 + Z_2} \quad -(9)$$

$$I_2 = 2I_1 \frac{Z_2 - Z_1}{Z_1 + Z_2} \quad -(10)$$

From the above equations we deduce the following:

(1) The reflected waves are annulled when $Z_1 = Z_2$

(2) When Z_2 is greater than Z_1 the wave is partially reflected with reversal of current.

(3) When Z_2 is less than Z_1 the wave is partially reflected with reversal of voltage.

(4) When Z_2 is greater than Z_1 the voltage wave is increased at the transition point. This accounts for the fact that a disturbance originating in an overhead line connected to a cable passes through the latter with reduced voltage, and in passing through the cable to a transformer the voltage is increased. (See Figure 13).

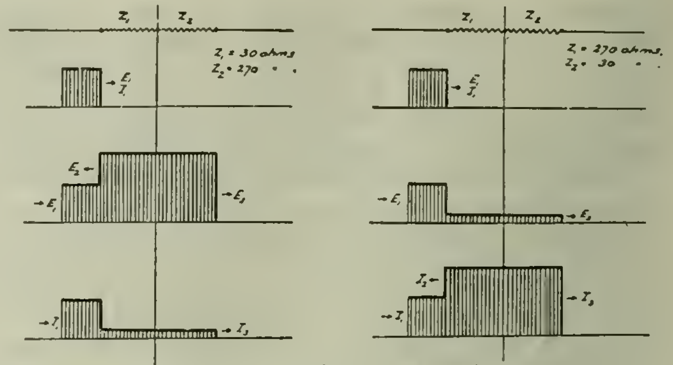
We shall now apply the above equations to three important cases, viz. when $Z_2 = R$, $Z_2 = \infty$ and $Z_2 = 0$

(1). Let $Z_1 = Z$ and $Z_2 = R$
then (8) becomes $E_2 = 2E_1 \dfrac{R - Z}{R + Z}$

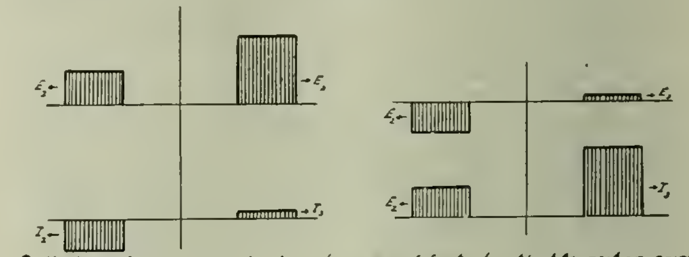
When R = Z the reflected wave is annulled and all the energy is dissipated into heat. (See Figure 13).

When resistances are used in conjunction with protective apparatus, it is usual to make R greater than Z; in which case the voltage wave is partially reflected back into the line.

(2). When $Z_2 = \infty$ this corresponds to an open circuited line



Reflection & transmission of rectangular wave of infinite length at transition point of two circuits of different surge impedances



Reflection & transmission of rectangular wave of finite length at transition point of two circuits of different surge impedances.

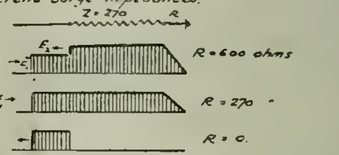


Fig 13.

Reflection of rectangular wave - line closed by resistance.

$$E_3 = 2E_1 \frac{Z_2}{Z_1 + Z_2} = E_1 \times \frac{2 \times \infty}{Z_1 + \infty} = 2\,E_1$$

$$I_3 = 2E_1 \frac{Z_1}{Z_1 + Z_2} = 2E_1 \frac{Z1}{Z_1 + \infty} = 0$$

The wave is reflected with reversal of current and the potential doubled at the point of reflection.

(3). When $Z_2 = 0$ this corresponds to a line short circuited at one end.

$$E_3 = 2\,E_1 \frac{Z_2}{Z_1 + Z_2} = E_1 + \frac{2 \times 0}{Z_1 + 0} = 0$$

$$I_3 = 2\,I_1 \frac{Zl_1}{Z_1 + Z_2} = I_1 = \frac{2\,Zl_1}{Z_1 + 0} = 2\,I_1$$

The wave is reflected with reversal of voltage and the current doubled at the point of reflection.

Experimental confirmation of the three cases just investigated will be found in a paper by "Propagation of Impulses Over a Transmission Line" by Cunningham and Davis, A.I.E.E. Vol. XXXI, 1912. This paper is well worthy of careful study.

We shall now discuss the case of a resistance shounted at the transition point of two circuits of different surge impedances.

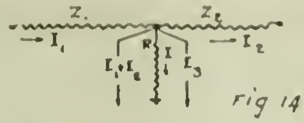


fig 14

$$E_1 + E_2 = E_3$$
$$I_1 - I_2 = I_3$$

$$\left.\begin{aligned} I_1 Z_1 &= E_1 \\ I_2 Z_1 &= E_2 \\ I_3 Z_2 &= E_3 \end{aligned}\right\} -(6)$$
$$I = \frac{E_3}{R}.$$

Solving

$$\left.\begin{aligned} E_3 &= 2E_1 \frac{Z_2 R}{Z_1 R + Z_2 R + Z_1 Z_2} \\ E_2 &= E_1 \frac{Z_2 R - Z_1 R - Z_1 Z_2}{Z_1 R + Z_2 R + Z_1 Z_2} \end{aligned}\right\} -(11)$$

$$\left.\begin{aligned} I_3 &= 2I_1 \frac{Z_1 R}{Z_1 R + Z_2 R + Z_1 Z_2} \\ I_2 &= I_1 \frac{Z_2 R - Z_1 R - Z_1 Z_2}{Z_1 R + Z_2 R + Z_1 Z_2} \end{aligned}\right\} -(12)$$

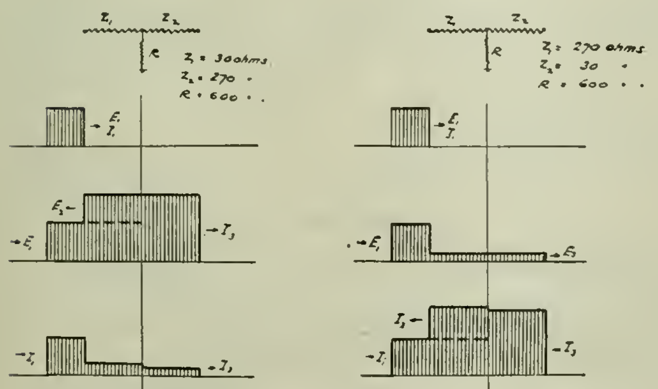
When $R = \frac{Z_1 Z_2}{Z_2 - Z_1}$ the reflected waves are annuled, i.e the wave enters circuit No. 2 unchanged.

When R is greater than $\frac{Z_1 Z_2}{Z_2 - Z_1}$ the wave is partially reflected with reversal of current and the voltage wave in circuit No. 2 is increased.

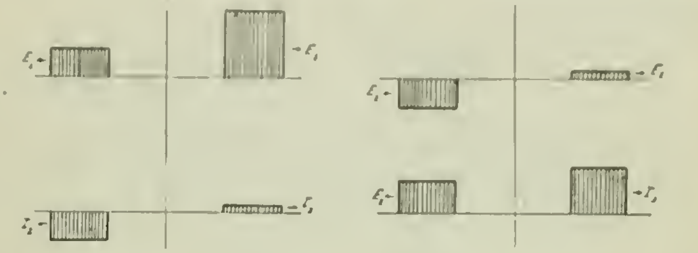
When R is less than $\frac{Z_1 Z_2}{Z_2 - Z_1}$ the wave is partially reflected with reversal of voltage, and the voltage wave in circuit No. 2 is decreased. Figure 15 shows the reflection and transmission of a restangular wave when

$Z_1 = 30$, $Z_2 = 270$, $R = 600$ and

$Z_1 = 270$
$Z_2 = 30$
$R = 600$



Reflection & transmission of rectangular wave of infinite length at transition point of two circuits of different surge impedances-resistance shunted at transition point

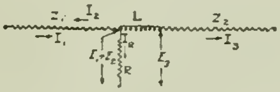


Reflection & transmission of rectangular wave of finite length at transition point of two circuits of different surge impedances—resistance shunted at transition point

It is impracticable to use shunt resistances permantly connected to the circuit on account of the ohmic losses; for this reason horn gaps or condensers are used in series. In this connection it may be of interest to note that another form of surge absorber consist of a resistance shunted by an inductance in series with the circuit to be protected. This device is also due to Campos and has been successfully used on high tension transmission lines in Europe, it has also been used to a limited extent in America, chiefly for the protection of high tension testing transformers, in conducting high voltage high frequency tests on transformers, etc.

We shall now investigate the changes involved by the combination of a series inductance and shunted resistance at the transition point of two circuits of different surge impedances.

Case I



$$E_1 + E_2 = L\frac{dI_3}{dt} + E_3 = \frac{L}{Z_2}\frac{dE_3}{dt} + E_3 \quad -(12)$$

$$I_1 - I_2 = I_3 + I_R \quad -(13)$$

Combining (12)&(13) we obtain.

$$\frac{dE_3}{dt} + \frac{Z_1R + Z_2R + Z_1Z_2}{L(Z_1 + R)} E_3 = 2E_1 \frac{Z_2 R}{L(Z_1 + R)}$$

$$\therefore E_3 = 2E_1 \frac{Z_2 R}{Z_1R + Z_2R + Z_1Z_2}\left(1 - e^{-\frac{Z_1R + Z_2R + Z_1Z_2}{L(Z_1+R)}t}\right) -(14)$$

$$I_3 = 2I_1 \frac{Z_1 R}{Z_1R + Z_2R + Z_1Z_2}\left(1 - e^{-\frac{Z_1R + Z_2R + Z_1Z_2}{L(Z_1+R)}t}\right) -(15)$$

from (1)

$$E_2 = E_1\left[\frac{Z_2R - Z_1R - Z_1Z_2}{Z_1R + Z_2R + Z_1Z_2} + \frac{2Z_1R^2}{(Z_1+R)(Z_1R + Z_2R + Z_1Z_2)} e^{-\frac{Z_1R + Z_2R + Z_1Z_2}{L(Z_1+R)}t}\right] (16)$$

$$I_2 = I_1\left[\frac{Z_2R - Z_1R - Z_1Z_2}{Z_1R + Z_2R + Z_1Z_2} + \frac{2Z_1R^2}{(Z_1+R)(Z_1R + Z_2R + Z_1Z_2)} e^{-\frac{Z_1R + Z_2R + Z_1Z_2}{L(Z_1+R)}t}\right] (17)$$

$$I_R = \frac{E_1 + E_2}{R}$$

$$= 2I_1\left[\frac{Z_2}{Z_1R + Z_2R + Z_1Z_2} + \frac{Z_1R}{(Z_1+R)(Z_1R + Z_2R + Z_1Z_2)} e^{-\frac{Z_1R + Z_2R + Z_1Z_2}{L(Z_1+R)}t}\right] (18)$$

Waves of finite length - The equations of the rear of the respective waves are as follows:—

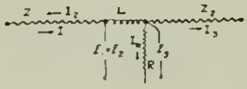
$$E_3' = 2E_1 \frac{Z_2 R}{Z_1R + Z_2R + Z_1Z_2} e^{-\frac{Z_1R + Z_2R + Z_1Z_2}{L(Z_1+R)}t} \quad -(19)$$

$$I_3' = 2E_1 \frac{R}{Z_1R + Z_2R + Z_1Z_2} e^{-\frac{Z_1R + Z_2R + Z_1Z_2}{L(Z_1+R)}t}, \quad -(20)$$

$$E_2' = -2E_1 \frac{Z_1 R^2}{(Z_1+R)(Z_1R + Z_2R + Z_1Z_2)} e^{-\frac{Z_1R + Z_2R + Z_1Z_2}{L(Z_1+R)}t} \quad (21)$$

$$I_2' = -2E_1 \frac{R^2}{(Z_1+R)(Z_1R + Z_2R + Z_1Z_2)} e^{-\frac{Z_1R + Z_2R + Z_1Z_2}{L(Z_1+R)}t} \quad (22)$$

Case II



$$E_1 + E_2 = E_3 + L\frac{d}{dt}(I_3 + I_R) = E_3 + L\left(\frac{1}{Z_1} + \frac{1}{R}\right)\frac{dE_3}{dt} \quad -(23)$$

$$I_1 - I_2 = I_3 + I_R \quad -(13)$$

$$\frac{dE_3}{dt} + \frac{Z_1R + Z_2R + Z_1Z_2}{L(Z_2+R)}E_3 = 2E_1\frac{Z_2}{L(Z_2+R)}$$

$$E_3 = 2E_1\frac{Z_2R}{Z_1R+Z_2R+Z_1Z_2}\left(1 - e^{-\frac{Z_1R+Z_2R+Z_1Z_2}{L(Z_2+R)}t}\right) \quad -(24)$$

$$I_3 = 2I_1\frac{Z_1R}{Z_1R+Z_2R+Z_1Z_2}\left(1 - e^{-\frac{Z_1R+Z_2R+Z_1Z_2}{L(Z_2+R)}t}\right) \quad -(25)$$

$$E_2 = E_1\left[\frac{Z_2R-Z_1R-Z_1Z_2}{Z_1R+Z_2R+Z_1Z_2} + \frac{2Z_1(Z_2+R)}{Z_1R+Z_2R+Z_1Z_2}e^{-\frac{Z_1R+Z_2R+Z_1Z_2}{L(Z_2+R)}t}\right] \quad -(26)$$

$$I_2 = I_1\left[\frac{Z_2R-Z_1R-Z_1Z_2}{Z_1R+Z_2R+Z_1Z_2} + \frac{2Z_1(Z_2+R)}{Z_1R+Z_2R+Z_1Z_2}e^{-\frac{Z_1R+Z_2R+Z_1Z_2}{L(Z_2+R)}t}\right] \quad -(27)$$

Waves of finite length :- The equations of the rear the respective waves are as follows

$$E_3' = 2E_1\frac{Z_2R}{Z_1R+Z_2R+Z_1Z_2}e^{-\frac{Z_1R+Z_2R+Z_1Z_2}{L(Z_2+R)}t} \quad (28)$$

$$I_3' = 2E_1\frac{R}{Z_1R+Z_2R+Z_1Z_2}e^{-\frac{Z_1R+Z_2R+Z_1Z_2}{L(Z_2+R)}t} \quad (29)$$

$$E_2' = -2E_1\frac{Z_1(Z_2+R)}{Z_1R+Z_2R+Z_1Z_2}e^{-\frac{Z_1R+Z_2R+Z_1Z_2}{L(Z_2+R)}t} \quad (30)$$

$$I_2' = -2I_1\frac{(Z_2+R}{Z_1R+Z_2R+Z_1Z_2}e^{-\frac{Z_1R+Z_2R+Z_1Z_2}{L(Z_2+R)}t} \quad (31)$$

Figure 16A shows the transmission or reflection of a rectangular wave of infinite length. The following assumptions are made:

Z_1 = 30 ohms, Z_2 = 270 ohms, R = ohms L = .00025 henry.

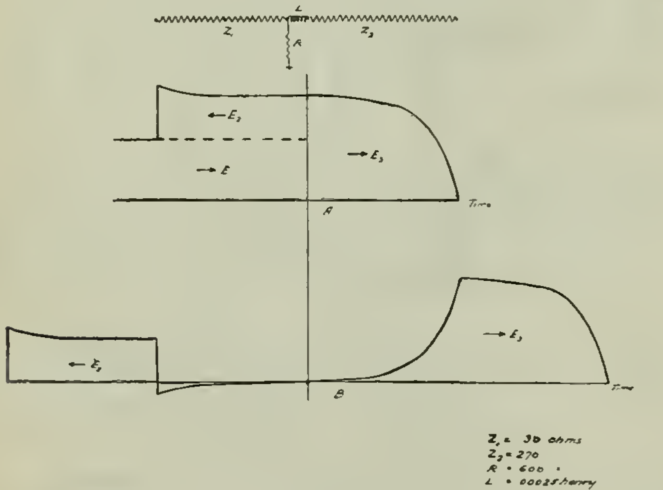


Fig 16

Figure 16B shows the same for a rectangular wave of finite length. In this case the following points should be carefully noted:

1. The wave fronts are smooth.

2. The abrupt change in the reflected wave. This is due to the fact that the choke coil acts at the first instant as an infinite impedance, i.e. an open circuit. The wave is, therefore, fully reflected.

3. Local drop of potential at the transition point.

4. The final values of the transmitted and reflected waves are respectively the same as in the case previously discussed, viz., shunted resistance at the transition point. (c.f. 11 and (12) with (14) and (15) also (24) and (25).

5. The energy stored in the inductance L is discharged into circuits Z_1 and Z_2 in the ratio of

$$\frac{Z_1}{Z_2} \times \frac{R^2}{(Z_1 + R)^2} \quad \text{Case (1)}$$

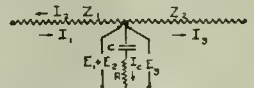
$$\frac{Z_1}{Z_2} \times \frac{(Z_2 + R)^2}{R^2} \quad \text{Case (2)}$$

In the former case the energy is discharged into a circuit in which Z_2 is connected in series with Z_1 and R in multiple. In the latter case the energy is discharged into a circuit in which Z_1 is connected in series with Z_2 and R in multiple.

6. The time constant in Case No. 1 is much higher than in Case No. 2, so that the oscillations are damped out much more rapidly in the former than in the latter case. If Z_2 represents a transformer or other station apparatus then it is usual to connect the resistance as shown in Case No. 1.

(Note. This type of arrester is installed at the station end and at the junction points of the aerial and underground distributing circuits).

Passing now to the condenser, resistance arrangement or surge absorber. The complete solution is given below:



$Z_1 = \sqrt{\frac{L_1}{C_1}}$ $Z_2 = \sqrt{\frac{L_2}{C_2}}$

Let E_1 E_2 E_3 represent incident reflected & transmitted voltage waves respectively.
" I_1 I_2 I_3 " " " " current " "

$$E_1 + E_2 = E_3 \quad -(4)$$

$$I_1 - I_2 = I_c + I_3 \quad -(32)$$

$$E_3 = I_cR + \frac{1}{c}\int_0^t I_c\,dt \quad -(33)$$

$$\therefore \frac{1}{c}\int_0^t I_c\,dt + I_c\left(\frac{Z_1R+Z_2R+Z_1Z_2}{Z_1+Z_2}\right) = 2E_1\frac{Z_1Z_2}{Z_1+Z_2}$$

differentiating & solving for I_c, note when $t = 0$ $I_c = 2I\frac{Z_1Z_2}{Z_1R+Z_2R+Z_1Z_2}$

$$\therefore I_c = 2I_1\frac{Z_1Z_2}{Z_1R+Z_2R+Z_1Z_2}e^{-\frac{Z_1+Z_2}{c(Z_1R+Z_2R+Z_1Z_2)}t} \quad -(34)$$

substituting I_c in (32) we obtain the following

$$E_3 = 2E_1\frac{Z_2}{Z_1+Z_2}\left(1 - \frac{Z_1Z_2}{Z_1R+Z_2R+Z_1Z_2}e^{-\frac{Z_1+Z_2}{c(Z_1R+Z_2R+Z_1Z_2)}t}\right) \quad -(35)$$

$$I_3 = 2I_1\frac{Z_1}{Z_1+Z_2}\left(1 - \frac{Z_1Z_2}{Z_1R+Z_2R+Z_1Z_2}e^{-\frac{Z_1+Z_2}{c(Z_1R+Z_2R+Z_1Z_2)}t}\right) \quad (36)$$

Substituting Z_3 in (8)

$$E_2 = E_1\left[\frac{Z_2 - Z_1}{Z_1 + Z_2} - \frac{2Z_1Z_2^2}{(Z_1+Z_2)(Z_1R+Z_2R+Z_1Z_2)}\, e^{-\frac{Z_1+Z_2}{C(Z_1R+Z_2R+Z_1Z_2)}t}\right] \quad (37)$$

$$I_2 = I_1\left[\frac{Z_2 - Z_1}{Z_1 + Z_2} - \frac{2Z_1Z_2^2}{(Z_1+Z_2)(Z_1R+Z_2R+Z_1Z_2)}\, e^{-\frac{Z_1+Z_2}{C(Z_1R+Z_2R+Z_1Z_2)}t}\right] \quad (38)$$

Waves of finite length.
The equations of the rear of the respective waves are as follows:—

$$E_3' = 2E_1\frac{Z_1Z_2^2}{(Z_1+Z_2)(Z_1R+Z_2R+Z_1Z_2)}\, e^{-\frac{Z_1+Z_2}{C(Z_1R+Z_2R+Z_1Z_2)}t} \quad (39)$$

$$I_3' = 2I_1\frac{Z_1Z_2}{(Z_1+Z_2)(Z_1R+Z_2R+Z_1Z_2)}\, e^{-\frac{Z_1+Z_2}{C(Z_1R+Z_2R+Z_1Z_2)}t} \quad (40)$$

$$E_2' = 2E_1\frac{Z_1Z_2^2}{(Z_1+Z_2)(Z_1R+Z_2R+Z_1Z_2)}\, e^{-\frac{Z_1+Z_2}{C(Z_1R+Z_2R+Z_1Z_2)}t} \quad (41)$$

$$I_2' = 2I_1\frac{Z_2^2}{(Z_1+Z_2)(Z_1R+Z_2R+Z_1Z_2)}\, e^{-\frac{Z_1+Z_2}{C(Z_1R+Z_2R+Z_1Z_2)}t} \quad (42)$$

$$E_3^1 \quad E_2^1$$

It will be noted that $E_3^1 = E_2^1$ showing that the condenser impresses its voltage on the two circuits Z_1 and Z_2 which are in parallel with the condenser and resistance.

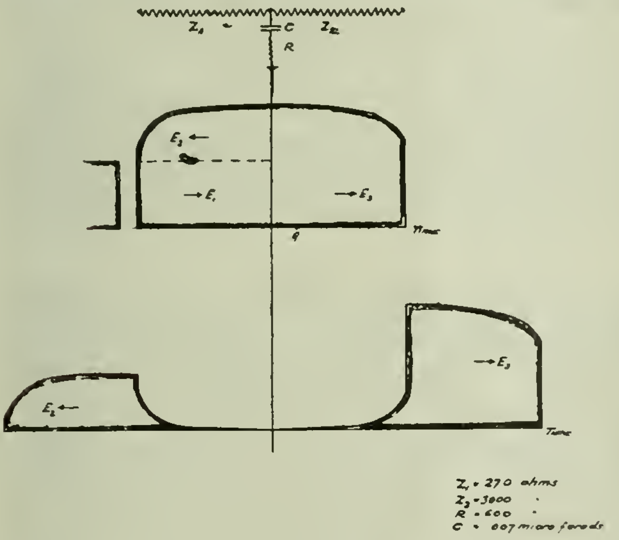


FIG. 17

Figure 17 shows the transmission and reflection of a rectangular wave of infinite length, and is based on the following assumption:

Z_1 = 270 ohms. R = 600 ohms.
Z_2 = 3000 ohms. C = .007 microfarads.

Figure 17B shows the same for a rectangular wave of finite length.

The following should be noted:

1. The wave fronts are not as steep as the original wave.

2. The condenser acts at the first instant as a negative resistance or short circuit, and impresses its voltage on the two circuits Z_1 and Z_2, as previously stated.

3. Local drop of potential at the transition point. This is far more important than the value of the reflected or transmitted wave.

4. The final values of the transmitted and reflected waves are the same as if the condenser and resistance were not present. (c.f. (7) and (8) with (35) and (37).

5. The time constant of the circuit is considerably increased by the introduction of the condenser and resistance at the transition point.

6. The rapid rate of energy absorbtion by the resistance is shown by the curve in figure 18.

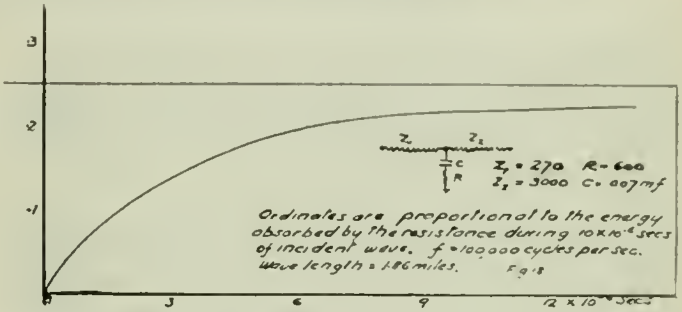


Fig. 18

It may be questioned whether one is justified in applying mathematics to the solution of problems of this character in view of the fact that engineers are by no means unanimous as to the relative value of protective apparatus in general, in fact, some engineers perfer to rely entirely on increased insulation on end turns, etc., and discard the use of lightning arresters in any form. It must be remembered, however, that the results obtained are qualitative rather than quantitative. The subject has been treated along similar lines by several European engineers and may be found by consulting the files of European technical publications. Owing to the limited technical library facilities in Montreal, a number of these publications were not available, so that the solution of the problems dealing directly with the protective devices described, had to be derived independently.

The theory of electric wave transmission was originally developed by Heaviside as early as 1887, and may be found by consulting his "Electrical Papers" Vol. II. We have also drawn freely from the writings of Steinmetz, Thomas, Faccioli, Pffiner, Berg and others.

It may be of interest to state that Mr. Faccioli intends to publish shortly an article in the "General Electric Review" giving the full theory of the condenser resistance, device and a number of other similar combinations.

In conclusion, we wish to express our thanks to R. M. Wilson, M.E.I.C., for suggestions and practical help in the preparation of this paper, and also to H. B. Simons and the other members of the Electric Generating Department.

Credit is due to W. W. Lewis of the General Electric Company, who designed the apparatus and made the original investigation leading to its adoption. We wish to express our indebtedness to him for the furnishing of certain technical references and advice.

This paper is necessarily incomplete and full responsibility rests on the writers for whatever defects it may contain.

The Hudson Bay Route

Resources, Conditions, and Development to Date

J. W. Tyrrell, M.E.I.C.

Read before Hamilton Branch, The Engineering Institute of Canada, Dec. 10th, 1920.

Although explorations and examinations conducted by many explorers, have been going on intermittently for more than three hundred years; Hudson Bay, strange to say, still remains a comparatively unknown sea, and an entirely undeveloped source of wealth to our country.

Although possessing an area five times as large as our great lakes combined, and a tidal coast line of about six thousand miles, at no place is this as yet accessible by any form of improved highway, and it can still be reached from the settled parts of Canada, only by means of canoes, small boats, or dog sleds, following the routes of our God-given streams. Into the Bay are discharged a score of mighty rivers, some of which rank among the largest on the continent, although an unfortunate feature of many of them is, that, they are very shallow at their mouths. Fortunately, however, there are some exceptions.

In connection with the problem of opening up the Hudson Bay route there are two very vital questions to be considered.

The former is briefly "Is the country worth opening?" and the second question is "By what route can it best be opened?".

If the local resources are of limited extent and little value then the difficulties of creating an outlet for commerce from our Western wheat-fields to Europe, by way of Hudson Bay and Strait Route assume a serious aspect; but if on the other hand the local resources are of large extent and great value, surely the success of a well-advised railway project to some point on the coast of Hudson Bay and a line of steamers connecting therewith is assured.

Animal Products

Probably the most valuable product is the Right, Bowhead or Greenland Whale, which is found in the Northern parts of Hudson Bay and Strait. It is the species from which the whale bone of commerce is derived, as well as a large amount of valuable oil. The commercial value of a single specimen ranges from five to twenty thousand dollars, depending upon the size, and consequent production of bone and oil.

Perhaps second in importance and value to the Right Whale fishery, is that of the White Whale — a much smaller though a very much more abundant animal. The oil and hide products of one animal being worth, on the average thirty dollars.

The Narwhal of Sea Unicorn is another valuable species of whale, found in the Northern parts of the Bay and Strait, but it is of comparatively rare occurrence. The remarkable feature about this animal is that it possesses a long spiral horn of very fine ivory, extending from the upper jaw directly in line with the body. The length of horn in an adult is frequently about eight feet, and in value is worth from $2.50 to $3.00 per pound.

The Walrus fishery probably ranks next in value to that of the white whale, for this, the largest species of the Seal family, is abundant almost everywhere throughout the Northern parts of Hudson Bay and the Strait. They delight to sport and feed upon the clams and other shell-fish, which they dig from the sand in the shallow waters with their long ivory tusks provided for that purpose. According to A. P. Low, the present Southerly limit of the walrus is found at the North Belcher Islands, in about latitude 52 deg. although, as is the case with many other animals, its range was formerly much farther South.

Since a walrus, like most other seals, sinks immediately when killed, a very large percentage of those killed by existing methods of hunting are completely lost. The harpoon and lance, with attached line and float, should therefore be the only implements used in the hunt for these animals. Upon one occasion with a boat's crew of eleven men, near the shore of the Digges Islands, we were suddenly confronted by a herd of about fifty walruses—all of them snorting and blowing and looking like so many demons. With heads and shoulders above the water and their long curved ivory tusks gleaming in the sunlight, they charged straight for our position and so terrified some of our sailors that they were with difficulty restrained from jumping overboard into the sea. We were not properly outfitted at the time for walrus hunting — being armed only with five Winchester rifles — but with these we opened a rapid fire and demoralized the band before any of them reached our boat.

Many of them were killed and sank in deep water before they could be secured, but to one we managed to make fast, and towed him to the shore — a shelving sandy beach. But when we undertook to haul him out of the water, we realized for the first time the enormity of his bulk and weight. Although eleven able-bodied men, we could not without "purchase" commence to pull the carcase from the water, and even with a parbuckle were only half successful.

The weight of a single hide will average about two hundred and fifty pounds, and the ivory tusks which weigh anywhere from two to ten pounds, are worth about 75c. per pound. The oil derived from Walrus blubber is of rather inferior quality and therefore not of great value. The total marketable products of a single adult walrus will therefore be worth between $30.00 and $40.00.

Norway House

The Square-flipper, Bearded or Big Seal ranks next in size to the Walrus being commonly about eight feet in length, and is widely distributed though not very numerous. The hide is largely used by the Eskimos for the best grades of leather, and the oil product is also of considerable value.

The Harp or Saddleback Seal is the species most commonly found in great numbers off the Banks of Newfoundland, but it is not frequently met with in Hudson Bay, though quite commonly in the Strait. It is valuable for hide and oil products.

The Ringed or Jar Seal, though the smallest, is the most common and abundant species found in Hudson Bay and adjacent waters.

The Harbour or Freshwater Seal is the fifth and last variety of this animal found in Hudson Bay and adjacent waters, and though not numerous it is widely distributed. It is highly prized by the Eskimos because of its beautiful dark rich furry coat, that of the young being soft and rich — somewhat like that of the fur seal. Unlike the other varieties, it frequents the fresh water, ascending rivers and being found in fresh water lakes of high elevation.

The Polar Bear may be regarded in the animal world as the monarch of the Hudson Bay region. He is found about as frequently in the water as upon the land — having a very wide range over which he roams throughout the year — following the general movements of the seal and other animals upon which he preys. The female polar bear resorts to the shelter of some friendly snow-band during the winter months, and there gives birth to her young in the month of March; but the males do not hibernate, preferring rather to take their chances of an occasional cold meal whilst roaming their solitary fields of ice and snow.

The skin of the polar bear forms a beautiful and valuable robe, whilst the blubber affords a fine grade of oil, but the chief value of the animal is as a prize for the sportsman.

The Reindeer of the Hudson Bay country is to-day what the Buffalo was to the Western plains forty or fifty years ago, the chief source of food to the natives. They exist today in countless numbers but as they have been described at considerable length on former occasions no further mention will be made here.

The Musk Ox is one of the noblest and most valuable animals of the Northern shores of Hudson Bay and adjacent territory. It is found in very considerable numbers and affords most luxurious robes.

Woodland Caribou, Moose and Jumping Deer are found in more or less abundance throughout the timbered country about the Southern parts of the Bay; so also are Black Bears, Wolves and Colored Foxes. Black and Red as well as White Foxes, are commonly found in the country North of the timber line.

Other fur bearing animals which may be mentioned as products of the Hudson Bay country are Otter, Beaver, Fisher, Mink, Martin, Ermine, Wolverine, Lynx, and Wild Cats.

Little definite information seems to be available regarding the varieties and abundance of fish in Hudson Bay and Strait, but certain it is that some of the finest fish have come from those waters. From personal knowledge the writer can vouch for the following species:—

Salmon of the very finest quality are found in abundance both in Hudson Bay and Strait.

Lake Trout are found in all the streams and lakes tributary to the Bay.

Sturgeon are plentiful in the Nelson, Churchill and some other rivers flowing into the Bay.

Whitefish are caught in the mouths of several of the rivers by the Hudson's Bay Company, and salted in barrels for export.

Cod have been found at a number of points in the Northern parts of the Bay and Strait, and in Ungava Bay of late years a most successful cod fishery has been carried on by Senator Blanchard, a progressive and wealthy Newfoundlander.

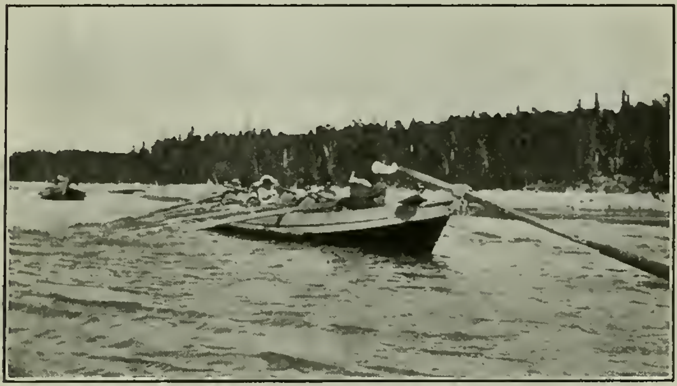
Doubtless other varieties of deep water fish will be found when properly fished for, but as yet this has not been done so far as the writer is aware.

Of feathered game there is a great abundance, particularly waterfowl, the most important of which are:— Brant, Hutchins, and Snowy Geese, Northern, American and King Eiders, Squaw Ducks, Swans, Loons, Murres, Quillemots, and many other sea fowls. Ptarmigan also are found in great numbers in many places in the open country. They are commonly caught by the natives with nets and form a staple article of food.

Vegetable Products

Under this heading, in the Northern parts of the Hudson Bay territory, we can count upon nothing for export, although in the valley of the Thelon and some other rivers there are valuable belts of spruce and tamarack timber for local supply when required. Nearly all of the Southern part of the territory South of latitude 58 deg. is, however, more or less heavily wooded with White and Black Spruce, Tamarack, Poplar, Birch, Pine, Balsam, Cedar, Elm and Ash here given in order of their abundance.

Very large quantities of milling timber are found in the valleys of all the large rivers emptying into the Southern shores of Hudson and James Bay, while the available supply of pulpwood is almost unlimited.



Navigation on the Nelson River

Agricultural development is not to be expected anywhere in the Northern parts of the district, but throughout the more Southerly wooded portions there are great possibilities in this direction. At Port Churchill there are a few hardy garden vegetables grown for local use, but at York, 120 miles farther South, many varieties grow luxuriantly; and the writer believes at Moose Factory, and other Southern points almost all kinds of farm produce have been raised successfully. This being the case, there are millions of acres of agricultural lands between the shores of the Bay and the height of land to the South of it.

Mineral Products

Of these little can as yet be said excepting as to prospects. Many valuable minerals have been sighted in various parts of the territory, but as yet no systematic prospecting has been undertaken, and with few exceptions, therefore, no reliable information is available as to qualities or quantities of minerals discovered.

Iron Ores are known to occur in several localities notably along the East main coast and the adjoining islands, on the West coast of Ungava Bay, and the South shore of Hudson Strait, also upon the Mattagami River.

Galena is known to exist in workable quantities at Richmond Gulf and Little Whale River, a few tons of ore having been mined near the Hudson's Bay Coy's. post at the latter place. Doctor Bell reports assays of two samples of this ore as yielding 5.104 and 12.03 ounces of silver to the ton.

Gold and Silver are also reported to have been found in small quantities upon the East main coast, near Great Whale River and Dog Island; also on the West coast South of Rankin Inlet where a large area of the Huronian or Keewatin schists occur. Again both metals were discovered in small quantities in samples obtained from one of the most Northerly of the Ottawa Islands.

Molybdenum is reported to have been found upon the East Main Coast.

Copper has been discovered both on the East and the West coasts, though in unknown quantities.

Lignite is reported to have been discovered on the Missinaibi River, Gypsum on the Moose, and Petroleum-bearing limestone on the Abittibi.

Good qualities of building stone are available on both the East and West shores of the Bay. Large quantities of Soapstone occur at Mosquito Bay, on the East Coast, and abundance of Mica has been discovered in Chesterfield Inlet, Eastmain and Lake Harbour, a mine being now profitably worked by a Scotch whaler at the latter place, not far from where I spent the winter of 1885-86. Mr. Low reports that in 1904 thirteen tons of excellent Mica were taken from this mine.

Graphite has been found on the East shore of Ungava Bay, in White Strait, and near Cape Wolstenholme.

Conditions

Having briefly reviewed the prospective resources of Hudson Bay, and believing that they are quite sufficient coupled with the assured through traffic in grain exportation — to warrant the opening up of a well advised steam route to some port on the shores of the Bay and thence through the Bay and Strait to the markets of the world, we shall now enter into a careful consideration of the questions of navigation. In doing so the writer is not unmindful of the fact that we are taking up a question, which has been under serious consideration and investigation for years past, so far without material results.

As compared with existing routes to Europe, the distance from Port Churchill or York, to Liverpool is about the same as that from Montreal to Liverpool, by way of Cape Race; while the distance from a central interior point, such as Prince Albert to Churchill is more than twelve hundred miles less than to Montreal. From Regina to Churchill the saving in rail travel would be over one thousand miles, and from Edmonton it would amount to more than eleven hundred miles.

The simple statement of these facts, coupled with our knowledge of the yearly congestion of traffic upon the existing railroads, and their excessively high freight charges — which have to be paid by our Canadian producers — together with the great desirability of developing the local resources of the Hudson Bay, constitute the chief arguments in favour of the establishment of a "Hudson Bay Route".

In determining the location of such a route, the first great question is the selection of a terminal or sea port on the coast of the Bay.

From a glance at the map, because of their geographical positions, the choice would naturally fall upon Severn, Nelson or Churchill, consequently an examination of the merits or claims of these three places becomes necessary.

Severn may be eliminated because of the exceedingly shallow water and low coast line in that part of the Bay, and the choice left between the two remaining ports Nelson and Churchill, at both of which places extensive surveys have been made. In 1912 the Hon. Frank Cochrane — Minister of Railways — accompanied by his chief engineer and other officials formed an expedition to Hudson Bay and there and then selected Nelson as the terminal site. The following summer a party of engineers was sent up to prepare for construction work, and in due course expensive plant was shipped—notably a large suction dredge or sand sucker for the purpose of dredging out a channel and making a safe harbour in the mouth of the Nelson. Unfortunately the river bed at the mouth of the Nelson, was found to be composed of hard stratified clay and hard pan instead of sand or soft mud and consequently the dredge was quite inaffective.

Tracking up Lower Stretches of Nelson River

The following is a quotation from a report of the chief engineer dated June 1920.

"The amount of dredging we have done at Nelson is inconsiderable compared with what we have to do. The equipment we had at Nelson was not at all suitable for the work we had to do. — We have had the greatest possible need for a couple of dipper dredges. — We have been fiddling with the matter of dredging and have not made any real attempt."

This does not make very cheerful reading after six or seven years operations; especially when we couple with it an official statement appearing in the same report, that up to the 31st. of March 1919, $6,325,256.10 had been expended upon this harbour work besides $14,526,560.43, upon the Hudson Bay Railway leading to it. There is no fault to be found with the judicious expenditure of such an amount for construction work, but no engineer should undertake to handle hard pan with a suction dredge, and furthermore it is the writer's personal opinion that Nelson never should have been selected as the terminus — when a land-locked natural harbour such as Churchill is available and easy of entrance during all kinds of weather.

Neither would any unusual difficulty be met with in the construction of a railway to Churchill for during the summer of 1905, the writer made a special examination of this route from Lake Winnipeg to Churchill and found it perfectly feasible and so reported.

In connection with construction work at the mouth of the Nelson, so much difficulty and expense seems to have been involved, that the impression has spread that a mistake may have been made in the location of the Hudson Bay Railway and the selection of a terminal site.

With the object of investigating this question a Committee of the Senate was appointed last April, to collect information and prepare a report — which they have recently issued, and from which the following quotations are taken:—

Report of Senate Committee

"Your Committee took a large amount of evidence regarding the relative merits of the two Western ports, Churchill and Nelson. — Churchill was shown to be an absolutely land locked harbour, entirely protected from every wind no matter from which quarter it should blow, where a few ships could at all times ride at anchor in perfect security. Nelson on the other hand, has no natural protection from the sea, except such as it receives by reason of its remoteness from the body of the sea, there being a twenty mile stretch of shallows between it and deep water, — A very large amount of money has already been expended upon the harbour improvements at Nelson, but a much larger sum is still required before the present plans can be carried out. There seems to be considerable doubt whether or not, even when the proposed plans are completed, the harbour at Nelson will be an entirely safe one against an Easterly gale. — The present harbour of Churchill is rather small, but could easily be enlarged enough to accommodate all the trade likely to offer for many years to come."

Beyond the present deep water harbour, there is a large basin of shallow water, the bottom of which is composed of hard clay mixed with boulders which could be easily dredged, and the resultant harbour would be of its size one of the finest in the continent. — It is the opinion of this Committee that the Government would be well advised, if before expending any more money on the harbour works at Nelson, they were to appoint a Committee of expert engineers and railway builders to examine the route to Churchill, and ascertain, whether or not it is possible, — and what would be the cost and advantage of making Churchill the port and terminus of the Hudson Bay Road rather than Nelson.

The conclusions arrived at by the Committee of the Senate read as follows:—

"Your committee make the following findings upon the evidence adduced before them.

(1) That the Hudson Bay route is feasible and will probably in time be profitable.

(2) That the season of navigation under present conditions is at least four months in length, and may be reason of improvements in aids to navigation be considerably increased.

(3) That in the opinion of this Committee, sufficient care was not taken in the selection of Nelson as the terminus of the railway and that the Government should not make further important expenditure upon this post without first making a new and thorough examination into the relative merits of Churchill and Nelson as a terminus for the railroad.

(4) That the waters of the strait and rivers tributary to the bay teem with fish and valuable marine animals, and we believe that the Bay is equally well stocked but there has not yet been sufficient data collected as to the extent of the fisheries of the Bay to enable an authoritative statement to be made as to their value.

(5) That the mines already discovered in the Hudson Bay District are of sufficient number and richness to indicate the existence of great potential mineral wealth."

Heavy Rapids on Churchill River

Obstacles to Navigation

Outside of the harbours, the only obstacles to navigation occur in Hudson Strait, where at three points the channel is contracted to forty or forty-five miles in width. The first of these points counting from the West, is at the South of Nottingham Island, and here ice-jams are frequently met with during the early part of the summer and late in the Fall; but by careful observation of the wind and tidal currents, these obstructions may often be avoided by passing either to the North of Nottingham or to the South of Digges Island, between which and the mainland at Cape Wolstenholme there is deep water. The prevailing direction of the movement of the ice at this locality is from the North, so that it frequently happens that though drift ice may be hard ashore on the North side of Nottingham there is open water to the South of it. The extreme sluggishness of the magnetic compass is also a source of difficulty to the mariner in this quarter, but the establishment of lights and bell-buoys would largely overcome this.

The next point where difficulties in navigation are likely to be encountered is about half way through the strait at or South of Big Island. Here there is a strong prevailing set of current to the West along the North shore and to the East along the South shore, and these facts require to be carefully regarded by the navigation as also the direction of the prevailing winds which very largely control the position of any drifting ice that may be in those waters.

During the systematic taking of observations on both sides of the strait in 1885 and 86 it is notable that when ice was observed upon the one side "open water" was the rule upon the other and vice versa. The most advantageous channel would therefore seem to be fairly central inclining to the North or South depending upon whether the wind is Northerly or Southerly.

The third point of contraction is at the Eastern entrance to the strait between Resolution and the Button Islands and to this locality the above observations regarding currents and wind apply with equal force.

We cannot get away from the fact that a considerable quantity of drifting field ice is likely to be encountered in the Strait throughout the month of July and of course earlier, but by that time it is found to be so broken and softened by the action of the weather and water, as to be of little danger to ships — which with average steam power and suitably arranged propellors with attachable blades will be able to force their way through.

As to the occurrence of fog in Hudson Strait a comparison of carefully kept observations show less than one third the number of hours recorded in the Straits of Belle Isle.

As to icebergs they are occasionally met with in Hudson Strait being sometimes carried in along the North shore by the prevailing current from Davis Strait, but they are by no means of frequent occurrence, and not one tenth as numerous as off the Straits of Belle Isle.

The Strait can, in the writer's opinion, be relied upon for unobstructed navigation from the 15th. of July to the 15th. of November with a possible extention of two weeks at either end.

The proposition to open up a route for commerce through Hudson Bay and Strait is a wise and perfectly feasible move, both because of the service it will render in developing the local resources of the country, and because of the additional transportation facilities it will afford for the products of Western Canada, and Port Churchill is by far the most advantageous terminal site.

A History of the Geological Investigations Made in the Fort Norman Area of the Mackenzie River Basin, N.W.T.

Expedition to Fort Norman area, results obtained, predictions for the future, with an indication of obstacles to be overcome.

F. H. Link, Geologist with the Imperial Oil Company, Limited

Read before Edmonton Branch, The Engineering Institute of Canada, April 19th, 1921.

Introduction

An attempt to give a complete history of any sort of work or people is usually impossible, no matter how much pain is taken by the compiler or historian, omissions and errors are bound to creep in, and then again if the reader is bored with all sorts of details the history usually becomes very uninteresting and tedious to read.

In the following chapters only the most prominent epoch making, and strictly geological expeditions made in connnection with the Fort Norman area will be touched upon.

It is generally known that Sir Alexander Mackenzie was the first white man to discover the oil seepages in the river basin named after him, and that many other pioneers have called attention to their existence. Since this paper is to deal only with the history of the strictly Geological Investigations of that area, the starting point will not be in 1789, when Mackenzie made his expedition, but about 80 years later.

F. B. Meek's Report of 1867

The first strictly geological report written on the Mackenzie river district, was published in 1867. This paper written by F. B. Meek and appeared in the Transactions of Chicago Academy of Science, under the heading "Geology of the Valley of the Mackenzie River."

The report was primarily a paleontological one and contained descriptions of fossils collected in the Hay River Valley, near Great Slave Lake, from the Ramparts on the Mackenzie river and from outcrops opposite the Grand View. Several plates with diagrams and photographs of the fossils appeared in the report.

The big Chicago fire took place soon after these publications had come off the press, and consequently only a very few copies of that report are available today.

R. G. McConnell, 1887

In 1887, R. G. McConnell of the Canadian Geological Survey made an extensive reconnaissance geological trip throughout the greater part of the Mackenzie river basin. His description of the oil-pools at Windy Point, the oil shales below Fort Good Hope and various other places have been read by the public since 1891. It is interesting to note that he made no mention of the oil seepages at Oil Creek, 53 miles below Fort Norman, where the first test well by the Imperial Oil, Limited was sunk, and from his map one can gather that they never were observed by him. In fact his map does not even show Oil Creek or any mark indicating these large seepages. This is due to the fact that in the immediate vicinity of Oil Creek his geological observations were all confined to the opposite side of the river, which is at Oil Creek approximately four miles wide.

The vast amount of geological data which McConnell gathered during his expedition shows that he was a keen observer and a hard worker, and too much credit cannot be given to him for his classic report on the Mackenzie River Basin. Unavoidable mistakes were made, but these are overshadowed by the remarkable way in which he treated that subject, and in general his correlations, as is the case with most of the pioneers, are correct.

Whiteaves, Bell, Keele, 1891, 1910

Description of the fossils collected by McConnell were published together with several plates by the Canadian Geological Survey, under the heading "Fossils of the Devonian Rocks of the Mackenzie River Basin," by J. F. Whiteaves.

In the Annual Report of the C.G.S. XII (1899), Geological data from the Mackenzie River as observed by R. Bell was published. In this report no mention of the oil was made.

In Publication No. 1097, J. Keele wrote a geological report on the Pelly, Ross and Gravel Rivers. The latter joins the Mackenzie River some 50 miles above Fort Norman. Likewise in this report the oil seepages were not dealt with.

Oliver, 1908-1909

According to information given by Dr McInnes of Edmonton, a certain geologist named Oliver, who was representing the Standard Oil Company, of Ohio, made a two-year trip up into the Mackenzie River Basin in 1908-1909.

This report was, as far as can be learned, favourable, but no action on the part of the Ohio Standard Oil Company, was taken to do any development work, and no claims were staked.

Bosworth, 1914

The second geological expedition which was sent to the North country with the sole intention of prospecting for oil was the one headed by Dr T. O. Bosworth, in the interest of a Calgary Syndicate. During the season of 1914, this party made a reconnaissance investigation of the Tar Sands on the Athabasca River, the oil seepages and the related geology on Great Slave Lake, and all the available geological features connected with petroleum on the Mackenzie River, from Great Slave Lake as far as 110 miles inside the Arctic Circle.

This expedition must, therefore, be regarded as the starting point of the Fort Norman Oil Field development, and is an epoch in the Petroleum Industry. The manner in which Dr. Bosworth dealt with the data he acquired under great difficulties shows that he had grasped the great significance of the seepages, and it also shows he realized that conditions favourable for possibly several great oil-fields exist.

In his report he dealt with the tar sands of the Athabasca; he discussed the oil-pools at Windy Point with the geology in the immediate vicinity; and the oil seepages 53 miles below Fort Norman together with the geological features found immediately on the banks of the Mackenzie river as far as Old Fort Good Hope, were dealt with in admirable form, especially when it is considered that little time was available to make detailed observations.

At the Foot of the Bear Mountains.
A View only for Those who Endure Hardships.

By reading Dr Bosworth's report, one is impressed by the faith which he had in the possibilities of the field. However, he was very reluctant about making predictions about the success of the first test holes, and in an article written by him before the news of the strike at Fort Norman had reached him, and which occurred in the March issue of "Oildom" he made the following statement:—

"A preliminary test well is being drilled this year about 40 miles beyond Fort Norman. It is quite possible that this first well will meet with no success—but in view of the favourable conditions, the numerous showings of oil, and their widespread occurrence throughout such a vast territory, it is considered that a number of oil fields must eventually be proved."

Four and one-half square miles near Oil Creek, and several square miles near Windy Point were staked by Dr Bosworth for his syndicate.

Cameron and Kindle, 1916-1917

In 1916 and 1917, a survey of the greater portion of Great Slave Lake was made by A. E. Cameron for the Canadian Geological Survey. In his preliminary report on the area considerable space was given to a discussion on the oil seepages around Windy Point.

During the 1917 season, Dr. Kindle was doing geological work for the survey on the Great Slave Lake area and the upper part of the Mackenzie River, as far as Fort Simpson. This work was primarily a paleontological research on the Devonian fossils, on which Dr. Kindle is one of the leading American authorities.

Season of 1919, Link and Kindle

Toward the close of 1917 Dr. T. O. Bosworth was made chief geologist for the Imperial Oil, Limited. The report which he made for the Calgary Syndicate in 1914, together with the claims staked in that year, were acquired by the Imperial Oil, Limited and due, primarily to Dr. Bosworth's insistence and efforts, two drills were brought in the spring of 1919 to test out the possibilities of the Fort Norman and Great Slave Lake areas.

The geological parties were fitted out to continue the work in the Fort Norman and Slave Lake areas respectively. T. A. Link was given charge of the former.

All the observations made by Dr. Bosworth in 1914 were carefully checked over, and soon it was found out that the vital and important exposures, which would lead to the correct solution of the stratigraphy and structure of the rocks, were to be found inland away from the Mackenzie river.

Consequently many inland trips through vast stretches of muskeg swamps, windfall and sloughs were made whereby mountains were climbed, creeks ascended, and points reached which were never previously seen by white men, and in many cases not even by Indians.

Under adverse conditions these prospecting trips were made and soon all the doubtful points in Bosworth's report were cleared up.

On August the 7th, 1919, the first shipment of drilling material and the crew arrived at Oil Creek. The well location was then definitely chosen after a great deal of trouble in landing the material. Due to an oversight on Dr. Bosworth's part to indicate his choice of location on his sketch map, the judgment of Mr. Link had to be based on the geological knowledge acquired by him before the arrival of the rig, and the location was therefore made 1000 feet West of the junction of the Bosworth-Proctor claims. According to Dr. Bosworth, that location was the one he had in mind, and thus the opinion of the two geologists, who worked independently, coincided and the science of geology has another successful location to its credit.

Additional geological work was done before the final shipment of materials had been landed at Oil Creek on September, 26th, and by that time enough data had been collected by Mr. Link to make the following statement in his report:—

"Oil will be encountered at a depth of not over 1000 feet and more probably between a depth of 50 to 500 feet."

The above statement that oil "will" be struck was a very bold one to make, but the verification of the predictions by the drill show, that with care, geological data can be used to a great advantage.

During the 1919 season Dr. E. M. Kindle was also making an extensive geological investigation of the Mackenzie River district in behalf of the Canadian Geological Survey. The area worked by him was practically the same as that covered by Mr. Link. However, on account of the fact that Dr. Kindle also worked in the Liard River and the stretch on the Mackenzie between Simpson and Norman, he was unable to make close observations and detailed work in the vicinity of

Oil Creek and inland thereof. The assistance which Dr. Kindle gave Mr. Link in determining fossils, while in the field, was well appreciated and proved very valuable.

The additional and revised geological data which appears on Publication 1585 (the most recent Government Geological Map on the Mackenzie River District), is based entirely on Dr. Kindle's information. His final report, however, has not been issued to date.

Cut Banks of Bed Rock on Tributary Stream—
Geologist's Paradise

Season of 1920, Link and Beede

The geological investigations continued in 1920, but before any more detail work could be done, accurate maps had to be made. The work of the last season consisted primarily of making an accurate survey of the Mackenzie river, and all tributary streams along whose banks valuable geological data could be obtained.

A seventy mile traverse along the Mackenzie river was therefore made, and the geological data was plotted as the map was made. On a much larger scale the important tributary streams were traversed and all the geological data was plotted with extreme care, along with the making of the maps.

Due to this painstaking method of procedure and the log of the first well, very definite ideas about the possible extent and the depths of the oil horizons have been arrived at. In connection with this, it is in place to remark that sad dissapointments are sure to come if all the claim holders expect oil on their property.

On August 25th, 1920, the big strike was made at Oil Creek. A very high grade of oil was struck, and the production of the well can be estimated to be about 200 barrels at the most. On account of the kind of rock in which the strike was made, it is highly probable that very soon the production of the well will decrease to 50 barrels or so.

In addition to the Imperial Oil geological party near Fort Norman, Dr. J. W. Beede of Texas, was carrying on work in behalf of Wm. Nicholson of Banff, Alberta.

Unfortunately Mr. Beede, who is a very capable geologist, also had to do some work on Great Slave Lake, and therefore his time was very limited. However, the manner in which the geological situation was grasped by Dr. Beede on the data which he had collected, showed his capability as a geologist.

The Future

More geological work will be done during the following seasons by government and private geologists. It will require many years before the situation is understood so that accurate predications can be made. However, if the work is carried on by capable men the solution of the problems are eventually bound to come. Mistakes will be made, and many dry holes will be sunk at locations indicated by the different geologists, but the sum total of their efforts will be to reduce the number of dry holes to a minimum.

Any attempt to predict what lies in the future for the possible Fort Norman Oil Field, will be purely speculative. The first well which gave results far greater than was expected, does not prove that a large oil field has been tapped. A great deal of time, money, entailing considerable hard work is to be spent before an oil field in that frozen North country is established. Thousands, and thousands of dollars will be spent and a few fortunate investors might become rich. Many more, however, will never get back the money which was spent, even if an oil field is developed.

More careful and painstaking geological work is necessary before the most promising areas can be defined, and any company or syndicate which does not realize this fact is bound to come to grief sooner or later.

To drill the first test well at Fort Norman it is stated, had cost the Imperial Oil, Limited somewhere in the neighbourhood of $150,000. The drill was not landed completely at Oil Creek until seven months had elapsed, and a great deal of luck and risks were connected with the transportation of that rig.

The Windy Point rig was not landed complete until the following year, or 16 months after it had left Edmonton.

Bear Mountains—Seven Miles from the Well

Before the building of a railroad or pipe-line, an out-put of about 30,000 barrels a day must be assured. That will require an expenditure of money which cannot even be guessed at. Then, if those 30,000 barrels are assured, the building of the pipe-line will require about fifty million dollars. The building of a railroad will cost about $30,000 per mile. Our heads begin to swim when an attempt is made to keep all those figures straight.

The whole affair puts one in mind of the man, who remarked to a prospector about a gold mine:—"That's a great mine, and they took an awful lot of gold out of it." "Yes," said the prospector, "But it took a ——— of a lot more silver to get it out." A great deal of "silver" will be needed to put the Ft. Norman field, even if there is plenty of oil there, on a paying basis.

THE JOURNAL OF
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OF CANADA

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Western Professional Meeting

The dates of the Western Professional meeting as suggested by the Saskatchewan Branch under whose auspices the meeting will be held have been confirmed by the Council and are Wednesday, Thursday and Friday, August tenth, eleventh and twelfth. The programme will be found below. This is, however, only tentative and will be enlarged and possibly altered.

One feature of this gathering will be a regular meeting of Council at which it is expected that the majority of the Western councillors will be present and to which the travelling expenses of one councillor from each province will be paid by headquarters. This meeting will afford an opportunity of a discussion of Western problems.

Wednesday, August 10th. Saskatchewan Branch.

Morning Session. Reception and Registering.
Opening Address by President of the Engineering Institute of Canada.
Development of Trunk Highways as affecting the Western Provinces, by C. W. Dill, including report of Committee on Standard Specifications for Highways asked for in 1918.

Afternoon Session. Concrete Research, by Prof. C. J. Mackenzie, M.E.I.C.
Telephone paper or demonstration of both, by W. R. Warren.

Thursday, August 11th. Alberta Branches and Winnipeg Branch.

Morning Session. Water Supply and Irrigation Schemes as affecting the Three Prairie Provinces, by G. N. Houston, M.E.I.C., Calgary, assisted by A. J. McPherson, A.M.E.I.C., Regina.
Coal Fields of the Four Western Provinces, Briquetting of Lignite and Fuel Economy, by R. DeL. French, M.E.I.C. and Wm. Pearce, M.E.I.C.

Afternoon Session.
Water Power and Electrical Transmission Systems, Messrs J. M. Leamy, M.E.I.C., and C. H. Attwood, A.M.E.I.C.
Possibilities of the Unexplored Northern Portions of the Western Provinces including Transportation, by Dr. Wallace, commissioner Northern Manitoba.

Friday, August 12th. General.

Morning Session General Welfare of the E.I.C., including Legislation, Engineering Education, Engineering Qualifications and Classifications, Remuneration, Closer Co-operation, by the members.

Afternoon Session. An Excursion.

Engineers and Patronage

The proposal before the Dominion House of Commons, known as the Spinney bill, to amend the method of appointing certain classifications of the Civil Service of Canada, including engineers and technical men by taking these appointments from the Civil Service Commission, by whom they are now made, and placing them in the hands of the Government, has created considerable discussion and much adverse criticism. The subject was taken up at the May meeting of Council and the result of the deliberations expressed in a telegram forwarded by President Fairbairn to the Hon. E. M. Spinney. That the Council of *The Institute* is strongly opposed to the change from the present method of appointment is shown by the resolution passed. The telegram reads:

Montreal, May 18th, 1921.

Hon. E. K. Spinney,
Chairman, Parliamentary Committee,
Civil Service Amendments,
Ottawa, Ont.

The Council of *The Engineering Institute of Canada*, representing four thousand five hundred professional civil, mechanical, and electrical engineers throughout the entire Dominion, respectfully submit that this Institute has continuously followed for many years the interests of the engineers in Government service and have proposed the following resolution with reference to the proposals to amend the Civil Service Act now under consideration:

That *The Engineering Institute of Canada* strongly approved the provisions of the Civil Service Act of nineteen eighteen so far as they affected engineers and endorsed the system of making appointments and promotions in the public service by merit and efficiency; that they endorsed without reservation the principles on which the classification of the engineering positions in the federal service was based, as approved in nineteen nineteen and appointed a committee to confer with and assist the Civil Service Commission in their work; that they place themselves on record as opposing and viewing with apprehension any alteration in the Civil Service Act by which appointments, promotions or matters of compensation are placed on any basis but merit, experience and efficiency and firmly believe that any change of this nature would prejudice the opportunities offered capable men for a career in the service of the Government and would injuriously affect the obtaining of a high standard in the personnel and work of its various departments which can only be secured when merit and merit alone is recognized.

J. M. R. Fairbairn,
President, *The Engineering Institute of Canada.*

The following reply has been received:—

Ottawa, 19th May 1921.

J. M. R. Fairbairn, Esq.,
Pres. Engineering Inst. of Canada,
Montreal.

Dear Mr. Fairbairn,

I have your telegram of yesterday addressed to me as Chairman of the Parliamentary Committee on Civil Service amendment, now before that committee for consideration.

The investigations by that committee have now been completed and a report will be presented to Parliament in a few days when their findings will be made public.

I am justified in assuring you that your organization will not be exposed to any hardship by the findings of the above committee.

Sincerely yours,
E. K. Spinney.

Council Meeting at Toronto

As suggested by the Ontario Provincial Division the question of holding a regular meeting of Council in Ontario has been in consideration for some time. At the meeting of Council held on May 17th it was resolved that a regular meeting of Council would be held in Toronto at a date to be decided by the Executive of the Ontario Provincial Division. It is proposed to have a meeting of the officers of the Division including officers of the Ontario Branches to take the nature of a conference at which the Councillors shall attend, followed by a regular meeting of Council.

Congratulations

Members of *The Institute* will join in congratulating two members of the profession who will be honoured at the coming convocation of the University of Toronto by having conferred upon them the degree of doctor of science.

President J. M. R. Fairbairn and immediate past president R. A. Ross are the men to whom a great University proposes paying this tribute. The occasion is one in which all engineers in Canada will take a just pride, for it is not alone a recognition of achievement of the two worthy engineers, but a signal mark of honour to the whole profession who will rejoice in the fact that two of their members have been given such a token of esteem by their Alma Mater. This degree is held by few in Canada and is a hall mark of excellence highly to be desired.

All engineers who can conveniently attend this memorable convocation on June 9th will no doubt be present to witness a function which will be a notable event in the engineering annals of Canada.

Members will be pleased to note that our esteemed Honorary Member and Past-President Sir John Kennedy had the honorary degree of Doctor of Laws conferred upon him by McMaster University on May 18th.

Remuneration and Classification

It had been expected that the question of remuneration and classification would be discussed at the meeting of Council on May 17th. Unfortunately the Committee which has been working for months on this matter was not able to submit its final report, although a tentative report covering the situation was presented to Council. This subject is one in which the great majority of the members of *The Institute* are vitally interested and on which action is expected. It is confidently hoped that at the meeting of Council in June the matter will come before Council for consideration and action.

Town Planning Notes and Comments

H. L. Seymour, A.M.E.I.C.

NOTE: — *In order to make this column of wide interest to members of The Institute, personals and items of town planning interest will be appreciated. Address: H. L. Seymour, A.M.E.I.C., 40 Jarvis Street, Toronto.*

John Brodie, Civil Engineer and Town Planner

John Alexander Brodie was elected in England last year as President of the Institution of Civil Engineers. Mr. Brodie, city engineer of Liverpool, is as well known as a town planner as a civil engineer. In his presidential address of the 2nd of November, 1920, when referring to methods of town development, he stated:

> Waves of enthusiasm in connection with town planning and housing have done a great deal of good by directing the attention of municipal engineers, surveyors, architects, builders and others, to the various problems connected with the proper planning and development of towns, and much has been done by conferences and lectures to broaden the view of public representatives on councils and committees...
>
> The real spadework of town development will no doubt continue to devolve on the municipal engineer, whose duty it generally is to advise from day to day and to deal with the engineering problems which lie at the root of the satisfactory planning and replanning of town areas, and who usually has the intimate knowledge of all local matters likely to affect the proper treatment of the area coming under his control.

University Courses in Town Planning

In last month's issue of *The Journal* of *The Engineering Institute of Canada* some mention was made of Town Planning lectures delivered at McGill and Toronto Universities. It might be mentioned that regular town-planning courses are now being given at London and Liverpool, England, and at Harvard University in the United States.

The following is an abstract from "Suggested Syllabus for an Option in Town Planning" for Fourth Year Students in Architecture and in Civil Engineering at the University of Toronto, prepared by Professor Adrian Berrington. Though such a course will probably not be made effective for some time it is given as an example of what education in town planning may involve:—

Suggested Course of 12 Lectures on General Principles and Examples of Town Planning

The Great Cities — Historical and Comparative. Illustrating the species of Fortress town, Cross-roads town, Bridge and Ford town, Harbour town, Artificial Capital city and Industrial agglomeration.

1. The Ancient. Athens, Rome, Alexandria and Roman Provincial beginnings, the Greek City State and the Roman fortified settlement.
2. The Mediaeval. Paris, Cologne, London and the Mediaeval type.
   The Royal, the Episcopal and the Free Cities.
3. The Modern. Florence, Berlin, Washington and the modern view point.
   The Modified, Planted and Industrial Cities and the latter day Impasse.

The Biology of Towns

4. The "Natural" town — from bare site via hamlet, village, country town, county town to city and metropolitan standing. Conditions of development.
5. The "Artificial" town. Comparisons of form and structure between these and the natural tracing of results from conditions of development.

The Organism and its Environment or Town and Country or City and Region

6. The interactions of Site. Product and People.
   Place x Work = folk; Folk x Place = Work; Work x Folk = place.

The Anatomy of Towns or the Integral Parts of the Civilized Community (European or Western Civilization).

7. The common Places — The Meeting and Market place — Agora, Forum. Grande Place, Halls, Markets, Shops, etc. etc.
8. The common Lands — Ancient, Mediaeval and Modern — Commons, Parks, Gardens and fore shores.
9. Local Government and its Services — City Halls and Walls Parish Pumps and Public Waterworks, Village Stocks and City Police Court Public Ownership.
10. Central Government and its Services — Castles, Keeps, Dungeons, Custom Houses, Law Courts, Barracks, Tax Offices, Post Offices, Centralized Control.
11. Recreation (and Education). Greek Stadium and Theatre, Roman Circus and Baths, Mediaeval Mystery Play and Fair, Modern Cinemas, Athletics, etc.
12. Education (and Recreation). The School, the University, the Abbey, the Studio, the Laboratory, the Museum, the Library, the Church, and the Ideas behind these at various times.

This course to be illustrated by diagram, plan and picture emphasizing the fact that constant Ideas tend to materialize in similar forms, whence it follows that accurate analysis gives guidance for suggestion and design.

Suggested Course of 12 Lectures on The Technique of Town Planning

Housing and Homing

1. Natural developments. Influences of speculation and profiteering. Uncontrolled real estate development.
2. Assisted and controlled developments. Comparisons. Urban and suburban examples.
3. Garden suburbs and Garden Cities. A discussion of existing examples.

The Satellite City

4. The essentially modern idea. Its social implications and dangers. Practicability. Examples.

Zoning or Planning Widely

5. What the word means. The natural zoning of ancient cities, funcitionally and economically maintained.
6. Causes of our present troubles. Instability of district and property values and character. Impossibility of scientifically adapted services.
7. The remedies proposed and employed. Their effects, benefits and difficulties. Examples.
8. Extensions and limitations of the idea. Old World examples. Character and quality in City and its quarters (wards).

Road, Rall and Water Ways

9. Through Ways. Regional and Civic Arteries. Local capillaries and feeders. Essential distinctions.
10. Methods of plotting these from statistics. Good and bad cross sections for each type (Roads only).
11. Comparison of square, radial and natural plans. Qualities and defects of each.
12. Technique of crossings, sidewalks, corners, subways, "round points" spaces, etc. etc. and Traffic regulation.

This course to be illustrated by all the relevant material available and reinforced by as much laboratory work on Canadian, Northern U. S. A., and British towns as possible.

Suggested Course of 12 Lectures on The Regional and Civic Survey. Methods and Application.

The Region—"Regionalisme"

1. The importance of a sufficiently high view point to see the boundaries of the real as distinct from the apparent Region. The several Regions. The necessity of harking back to the ancient time basis for computation of distance.
2. The Geological, Geographical, Hydrographical and Meteorological Survey — Flora and fauna. Maps, squared and contoured. Models.

The Existing Plan

3. Plotting to show streets: Plotting to show Property. Plotting to show Land Values. Building Values and Employ. Building Heights and density. Density of Population (Day and Night.)
4. Areas — for Local Government and other purposes. School areas. Fire areas; Sewage, Park, Playground and other Service Areas.
5. Supply — Regions of collection, centres of accretion and distribution, Areas supplied — as regards food, raw material and manufactured articles.

Communication — the Matrix of the Whole

6. Streets, Roads and High roads — Bridges and Tunnels — Arches and Gates — Barriers and tolls. Ferries. Statistics and graphic plotting of service and effects.
7. Rivers, canals and the Sea. Wharves and Harbours. Warehouses and Stations. Railroads enclosed and open. Modern roads and modern transport.

Local Government and Management and the Various Degrees of Civic Self-Control

8. Civic finance and property assessment. Studies in cause and effect in law and fact.
9. Building by-laws and hygienic regulations. Town planning laws and legal projects. Ideas and ideals. Private property and public interest.

Vital Statistics

10. The Census and the tales it tells — in conjunction with statistics of wealth. Birth. Malformation disease (physical and mental) and death rates.
11. The Homes, their size and situation and services. Their density, accessibility and amenity. Children, schools and playgrounds.
12. Recreation (for public benefit and private profit) and Reformation (Hospitals, asylums, Prisons and Proportions and placing.

This course to be illustrated in so far as possible by diagram, plan and picture, accompanied by laboratory work on diagrams, maps.

This year, besides the work at Toronto and McGill Universities as mentioned one or more lectures were delivered under the auspices of the Commission of Conservation at the following Universities: — Manitoba, Saskatchewan, Alberta, British Columbia, New Brunswick, Queens, Dalhousie and Acadia Universities.

General Notes

The Annual Meeting of the Town Planning Institute of Canada has been fixed for Friday and Saturday, May 27th and 28th, at Ottawa. Future Annual Meetings may be held in other cities.

W. A. Begg, A.M.E.I.C., town planning engineer of the Department of Municipal Affairs, in Saskatchewan, succeeds M. B. Weekes, M.E.I.C., as town planning director of the Province.

The National Conference on City Planning met this year in Pittsburgh, early in May.

Student and Junior Members take Majority of McGill Applied Science Honours in Graduation.

Out of the list of twenty-six names on the list of Faculty of Applied Science Honours recently issued by McGill University, eighteen are those of younger members of *The Institute* and congratulations from the older men are due. A list of the honours follows:—

Alexander Gordon Anderson, S.E.I.C., honours in electrical engineering.

Geo.W. Bain, S.E.I.C., fellowship in geology, British Association Medal; honours in ore deposits and economic geology.

James Barratt Brow,S.E.I.C., honours in ore deposits and economic geology.

John Brooke Congleton (Lord Congleton) Jr.E.I.C., head of mechanical engineering graduation class, winner of British Association Medal; honours in machine design, mechanical laboratory and experimental engineering power plant design, thermodynamics and hydraulics, Crosby Steam Gauge and Valve Company's prize for summer essay.

Harry Roy Cromwell, S.E.I.C., honours in ore deposits and economic geology

Frederick James Cunningham, S.E.I.C., British Association Medal; honours in electrical engineering, geodetic fieldwork, municipal engineering, strength of materials, theory of structures and hydraulics.

Charles Leonard Dewar, S.E.I.C., Douglas Fellowship in mining; honours in ore dressing and laboratory; undergraduate's society's first prize for summer essay.

Gaston Lalonde Fortin, S.E.I.C., honours in Municipal engineering.

Donald Ranald Harrison, S.E.I.C., British Association Medal; honours in general metallurgy, metallurgy, ore deposits and metallurgical laboratory, thesis and design.

Carl Henry Jackson, S.E.I.C., honours in electrical design.

Harry Wyatt Johnston, S.E.I.C., head of graduating class in mechanical engineering, British Association Medal; honours in physical chemistry, advanced inorganic chemistry, industrial organic and inorganic chemistry.

Jeffery Burland Macphail, A.M.E.I.C., honours in electrical engineering and municipal engineering.

James Buckland Mawdsley, S.E.I.C., honours in mining engineering.

Andrew Murray Robertson, S.E.I.C., The Drinkwater prize for summer essay, and undergraduate's society's third prize for summer essay.

Lloyd B. Rochester, S.E.I.C., McCall summer essay prize.

Following is the complete graduation list in the Faculty of Applied Science.

Chemical Engineering

Harry Wyatt Johnston, S.E.I.C., Frederick Gordon Green, S.E.I.C., Darrell Lorraine Calkin, S.E.I.C., Allan Blythe Copping, S.E.I.C., John Michael Cuddy, S.E.I.C., Christopher Montague Yates, S.E.I.C., Karl Forbes, S.E.I.C., John Metcalfe Purcell, S.E.I.C., James Othneil Challenger, S.E.I.C., Alfred Ernest Cockfield, S.E.I.C., William Dicker Stroud, S.E.I.C.

Civil Engineering

Frederick James Cunningham, S.E.I.C., Jeffrey Burland Macphail, A.M.E.I.C., Gaston Lalonde Fortin, S.E.I.C., Paul George Adrien Brault, S.E.I.C., John George Gardner, S.E.I.C., Louis O'Sullivan, S.E.I.C., Wilson James Muir, S.E.I.C., Réné Brunay Perrault, S.E.I.C., John Austin Loy, S.E.I.C., Andrew Murray Robertson, S.E.I.C., John Campbell Elder, S.E.I.C., Lawrence Forgar Carleton Hart, S.E.I.C.

Electrical Engineering

Alexander Gordon Anderson, S.E.I.C., Carl Henry Jackson, S.E.I.C., Trenholme Allen Gill Bishop, S.E.I.C., Milton Eaton, S.E.I.C., Morland Powers Whelen, S.E.I.C., Harold Joseph Acton, Stanley Clayton Hill, S.E.I.C., Thomas Enslow Phelan, Malcolm Gordon Stewart, S.E.I.C., Gordon Lorne Wiggs, S.E.I.C.

Mechanical Engineering

John Brooke Congleton, Jr.E.I. C.,James O'Halloran, S.E.I.C., Edward Blythe Maxwell, S.E.I.C., Reuel Burdett Mooney, S.E.I.C., John G. Hall, S.E.I.C., Lyall Radcliffe McCurdy, S.E.I.C.

Metallurgical Engineering

Donald Ranald Harrison, S.E.I.C., Jack Caswell Nutter, S.E.I.C.

Mining Engineering

George W. Bain, S.E.I.C., James Barrett Brow, S.E.I.C., James Buckland Mawdsley, S.E.I.C., Harry Roy Cromwell, S.E.I.C., Lloyd B. Rochester, S.E.I.C.

Queen's University Applied Science Graduation

The following Juniors, Student Members and others whose application is now in hand, are graduating this month from Queen's University in engineering with the degree of B.Sc.

With two exceptions, these graduates served in the Canadian forces overseas. Nearly all won commissions during service and all have had from one to three years experience in construction or design.

Andrew Grant Barrett, S.E.I.C., Robert Lincoln Bonham, Jr.E.I.C., Norman Melville Cooke, Walter Harvey Ellis, Fred James Ellis, S.E.I.C., James Vincent Fahey, Hugh Allan Gauthier, S.E.I.C., Vernon Wesley Isaac, S.E.I.C., Harry Jardine, S.E.I.C., Arthur Joseph Legault, Allan Clyde Malloch, S.E.I.C., Irvine Meridith Marshall, Howard Elliott Meadd, S.E.I.C., Wilson Stuart Mills, Garrett Daunt O'Connor, Frederick Arnold Sproule.

University of Toronto Applied Science Graduation

The following Junior and Student Members are graduating this month from the Faculty of Applied Science of the University of Toronto with the degree of B.A.Sc.

J. K. Affleck, S.E.I.C., honours, W. P. Port Augustine, S.E.I.C., A. C. Blue, S.E.I.C., honours, N. Bowman, S.E.I.C., honours, H. R. Burton, S.E.I.C., honours, W. D. Coulter, S.E.I.C., honours, P. J. Culliton, S.E.I.C., honours, R. W. Downie, S.E.I.C., F. W. Dunton, S.E.I.C., F. C. Eley, S.E.I.C., H. A. Fair, S.E.I.C., honours, J. R. Gilley, S. E. I. C., D. S. Graham, S. E. I. C., W. H. Herold, S.E.I.C., honours, J. H. Legate, S.E.I.C., A. H. Livingston, S.E.I.C., honours, H. K. MacLean, S.E.I.C., W. F. Mauder, S.E.I.C., honours, G. L. McGee, S.E.I.C., honours, L. T. McNaughton, S. E. I. C., J. C. Monteith, S.E.I.C., honours, W. J. Parker, S.E.I.C., W. G. Pinel, S.E.I.C., R. M. Prendergast, S.E.I.C., W. D. Proctor. J.E.I.C., honours, F. C. Richardson, S.E.I.C., honours, C. P. Sale, S.E.I.C., honours, J. E. B. Shortt, S.E.I.C., honours, J. A. Simmers, S.E.I.C., C. T. Smith, S.E.I.C., honours W. M. Smith, S.E.I.C., honours, M. C. Stafford, S.E.I.C., G. E. Steel, S.E.I.C., honours, F. H. Taylor, S.E.I.C., honours, V. Voaden, S.E.I.C., F. M. Waddell, S.E.I.C., honours, T. M. West, S.E.I.C., W. S. Wilson, S.E.I.C., A. H. Wingfield, S.E.I.C.

CORRESPONDENCE

Economy in Use of Canadian Coal

Editor, *Journal:*—

Dear Sir:

The writer wishes to bring to the notice of members of *The Institute* a condition which at present exists in the Canadian coal market and which they as engineers and good citizens should use their efforts to have corrected.

At the present time fuel is the dominent product in the public eye. It is the product that is going to make or break nations. A country that has the fuel and can market same to build up their own industries, or that can use their native coal and so avoid purchase of coal from other countries, will certainly have a better opportunity to go forward to normal prosperity than a country that has not the native fuel to develop on, and must necessarily purchase fuel from abroad.

It is needless to go into the coal resources of Canada, every engineer is aware of its position with regard to its potential wealth in coal; if not, he should dig into the subject and find out for himself. Figures might be quoted here, but the reader would have more actual knowledge of the bearing that the fuel has to his own and the prosperity of the country if he investigated the subject himself.

At the same time find out what tonnage Canada is providing for its own consumption and what tonnage it purchased outside the country. The result obtained should cause surprise that such a condition should be allowed to exist, let alone continue without intelligent protest or intelligent efforts to correct the reasons for such a condition. The main reason, as apparent to the writer and applying particularly to the Middle West, is the uncertainty as to costs. While the coals are different in their make up, equal results can be obtained from the use of Western Coals as with the best grades of American coal. At the present time the use of the Western coals show better economies than American coals, users that have adapted themselves to their differences are well satisfied with their use. However, there is an underlying feeling that the price of American coal will be considerably reduced and that equivalent reductions will not be probable with the Western coals due to different economics at the mines, the available markets, and also the long periods in which the mines are shut down due to the seasonal demands.

Referring particularly to the mines producing coal for domestic purposes. There is a more or less general feeling, one which seems to be fostered by the coal producers, that lump coal is what is desired and that smaller sizes have not the heat value that the lump has. There are also small sizes and slack that are sold for as low as 25 and 50 cents per ton, and having very little lower heat value than the lump sizes. This fuel value is demonstrated by the plants that are equipped for burning these small coals. While the small coals may not cost as much to mine as the lump coals the price offered is much below their cost, so that on this account it must be considered that the price paid for the lump coals must be higher than need be if the full value of the smaller coals could be obtained.

If the mine operators could be brought to this point of view they would no doubt make efforts to cure this economic loss, also the potential loss which they have in competitive prices. This is where the professional engineer can become of service by advocating the full use of existing methods for burning the small coals and also instituting research work for the further use of small coals both for power and for domestic use.

Any slack or small coals that can be sold for their equivalent value will reduce the selling price for the lump coals and so allow them to compete better with foreign coals. There is also the feature that it might be possible to create a demand for the production of the smaller coals which could be mined at a lower cost than lump sizes. This would still further increase the advantages in price in competitive market.

The American mines have been through a similar period during development. Slacks and waste which were dumped years ago, and at that time thought to have no value, are now being reclaimed and burned.

G. R. Pratt, A.M.E.I.C.

LIBRARY NOTES

Hamilton's Gear Book, by Chester B. Hamilton, M.E.I.C.

This handbook of forty-eight pages contains in a small space a considerable amount of useful information and tables. It is arranged as follows:—

Forms of Gear Teeth, Tables of Pitch Diameters for Diametral Pitch Gears, Pitch Diameters for Circular Pitch Gears, Tables of Tooth Parts, Diametral Pitch and Circular Pitch Diameter Increment, Tables and Diagrams of Gear Strengths, etc.

In addition to the above tables there are several pages of general information regarding gear manufacture.

*

Cam Design and Manufacture by F. B. Jacobs, published by D. Van Nostrand Company, New York; 122 pages, price $2.00.

As explained by the author the object of this textbook is to give briefly and without the use of complicated formulae information for the mechanical engineer concerned with design and manufacture of cams as part of regular routine. The first section of the book is occupied with a short discussion of cam design and layout, in all cases simple methods of design being indicated. There follow three valuable chapters on the actual processes of cam manufacture with examples taken from automobile shop practice. In the sections on cam cutting and grinding full information is given as to jigs and fixtures, milling cutters, and special grinding fixtures.

EMPLOYMENT BUREAU

To make this department more valuable it is proposed that in future advertisements of situations vacant should state salary, and give details of requirements.

Situations Vacant

Box 200.

The Civil Service Commission of Canada hereby give public notice that application will be received from persons qualified to fill the following positions in the Civil Service of Canada:—

Assistant Geologist

An Assistant Geologist at an initial salary of $2,100 per annum which will be increased upon recommendation for efficient service at the rate of $120 per annum until a maximum of $2,460 has been reached. This initial salary will be supplemented by whatever bonus may be provided by law.

Duties.—To assist in making areal, structural, and stratigraphical surveys of designated portions of one or more geographical or geological divisions of Canada; to assist in the instrumental survey and mapping of the topography and geology of certain areas; to perform detail work involved in the exploitation, geological investigation, and detailed survey of mines and mining areas showing the structure of ore bodies; to assist in the collection of mineralogical, palaeontological, geological, and other specimens; to perform detail work involved in the preparation for publication of reports, serial geological map-sheets with structural sections, monographs, and papers embodying the results of field work; to assist in the collection, classification, correlation, and arrangement for ready reference of data regarding the mineral resources and the geographical, petrographical, forest and other economic and geological features of areas investigated; and to perform other related work as required.

Qualifications.—Education equivalent to graduation in science from a recognized University, with at least two years post graduate study in geology. Several years experience in geological field-work. Special field knowledge of geology of Rocky Mountain region coal deposits. Some knowledge of modern geological literature and museum methods and of the significance, scope and economic importance of the Geological Survey. Preference will be given to candidates between the ages of 21 and 40 years on June 9, 1921.

A rating on Education and Experience will be given from the sworn statements submitted by applicants on their application forms. To those who qualify, an oral examination may be given, if necessary.

Application forms properly filled in must be filed in the office of the Civil Service Commission not later than June 9. Application forms may be obtained from the office of the Employment Service of Canada, or from the Secretary of the Civil Service Commission.

Professor of Mechanical Engineering

Professor of mechanical engineering for technical college in Nova Scotia. Candidate should be graduate of an engineering college or university and should have had both teaching and industrial experience. Salary $3000.00 per annum, college session October to June.

Box 200.

Situations Wanted

Civil Engineer

Civil engineer, graduate, A.M.E.I.C., age 33. Two years instrumentman and draughtsman. 3 years town resident engineer in charge of construction of sewerage and water systems, power house and pumping station. Desires position with contractors or engineers on construction or maintenance. Box 73-P.

Civil Engineer

Graduate civil engineer, A.M.E.I.C., at present employed desires change. Any locality, — Canadian or Foreign. English and French, and a little Spanish. Experience includes, railways, pneumatic foundations, municipal development, shipping piers, turbo-electric powerplants. Available at thirty days' notice. Details and references on request. Box 74-P.

Civil Engineer

Civil engineer, age 35, with twelve years experience as draughtsman, instrument man and engineer in charge. Experienced on harbour development and drainage, railroad construction etc., desires position with contracting firm. Open for engagement at once. Full particulars of experience and references furnished. Box 75-P.

Sanitary Engineer

Sanitary engineer desires position with progressive municipality or contractors. Good training and experience. Well versed level and theodolite. Excellent references. Served overseas with Sanitary Corps. Member of Professional Societies. Box 76-P.

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Members Exchange

Transit for sale

Transit for sale in good condition, Casella (English) make. The telescope is 8½″ long with stadia wires, horizontal circle 4½″ with two verniers, vertical circle is a complete circle also has two verniers, compass needle is 2″ long, transit has three levelling screws and shifting head, split leg tripod. This is a light transit, but is accurate and in good condition. It was purchased in 1910. Box 14-A. Price $125.

OBITUARIES

George A. Bayne, M.E.I.C.

Geo. A. Bayne, M.E.I.C., land inspector and chief surveyor for the Hudson Bay Co., died suddenly in Winnipeg on March 27th. Mr. Bayne was born at Londonderry, Nova Scotia, in 1850, and lived for seventeen years at Pictou, N.S. In 1872 Mr. Bayne came West with a Dominion government party assigned to survey Dominion lands. In 1876 he became contractor's engineer on section "B" of the Canadian Pacific Railway; went North for the Nelson Valley Railway in 1877; devoted himself to private practice as civil engineer from 1880 to 1885.

GEO. A. BAYNE, M.E.I.C.

The city of Winnipeg obtained his services in 1885 as assessor, and he was "borrowed" from the city to take charge of surveys and construction of the Portage la Prairie branch of what is now the Canadian National Railways. The Northern Pacific purchased the Portage branch and constructed the Morris and Brandon branch of which Mr. Bayne was engineer for three years. He was engaged on right-of-way surveys for the Canadian Pacific when asked by the Hudson's Bay Company in 1897 to undertake surveys at their inland posts. Immediately upon entering the service in the spring of 1897, Mr. Bayne went into the Northwest Territories for Hudson Bay Company. He laid out the timber reserve at the junction of the Slave and Athabasca rivers during that year. Early in 1898 he was ordered to the Nelson River District where he surveyed during that year the company's lands. In March 1899 Mr. Bayne went to survey the company's lands at the British Columbia posts. From 1900 until 1918 Mr. Bayne was engaged in inspecting the company's farming lands which are distributed from Lake Winnipeg and Lake of the Woods to the Rockies, and from North Saskatchewan river to the International boundary. Of the thousands of parcels of land still owned by Hudson Bay Company over this vast territory, few there are which have not been checked up and verified for acreage, soil, topography and surface growth by Mr. Bayne. Devoted to duty and an intense loyalty to the Hudson Bay Company, standards enabled him to rise to the deanship of his profession in the company's service.

Ralph J. Burley, M.E.I.C.

Ralph J. Burley, M.E.I.C., assistant director and chief engineer of the Drainage Division of the Reclamation Service, Department of the Interior, died on April 14th, 1921, at the home of his uncle, H. W. Burley, at Cressy, Ontario. The immediate cause of his death was a severe chill contracted on his journey to Cressy, whither he had gone to spend Easter with his grandmother and uncle, this led to a severe attack of rheumatism complicated with pleurisy; his heart, permanently weakened by a severe attack of inflammatory rheumatism some years before and by recurring attacks during more recent years, proved unequal to the strain and Mr. Burley passed away at the early age of thirty-nine.

Born at Waupoos about six miles from Picton, Ont., on July 30th, 1881, Mr. Burley spent his early years in that neighbourhood but removed to the West in 1892, with his parents; his father E. W. Burley later secured the appointment of provincial auditor to the Province of Alberta and now resides in Edmonton. After completing his high school courses in the West Mr. Ralph Burley matriculated at Toronto University in 1901 and graduated in Applied Science in 1904. During his undergraduate vacations Mr. Burley obtained some experience with the Irrigation Branch of the Department of the Interior and in 1905 was permanently appointed to that Branch with headquarters first at Regina and later at Calgary.

Throughout his whole service with the Department Mr. Burley's progress was steady and after ten years' varied experience in irrigation surveys and administration he was regarded as one of the most efficient irrigation engineers in the Government Service. It was in 1915 that what later proved to be a valuable opportunity to show his ability was offered Mr. Burley; he was assigned to investigate the problems arising from the Waterways Treaty between Great Britain and the United States regarding the measurement and apportionment between the United States and Canada of the waters of the St. Marys and Milk rivers for irrigation and power. That Mr. Burley thoroughly mastered the problems assigned to him became very evident when the case came before the International Joint Commission; his testimony given there was favourably commented upon by the Commissioners and was of the utmost value to the Dominion.

This case was of such importance, and Mr. Burley's grasp of the situation so complete, that he was transferred from Calgary to Ottawa in order that his expert knowledge might be more readily available to the chief of his Department. In 1919 when by reason of expanding responsibilities the Reclamation Service succeeded the Irrigation Branch and assumed full responsibility for both irrigation and drainage development in the western provinces, Mr. Burley's demonstrated efficiency led to his selection for the post of assistant director and chief engineer of the Drainage Division, and up to the time of his last illness Mr. Burley performed his duties to the entire satisfaction of the Department.

Mr. Burley's sterling character earned for him the confidence of his superiors and the loyalty and esteem of his subordinates. Although fully engaged with his official duties he nevertheless found time to devote to the service of the Professional Institute of the Civil Service, a recently organized body devoted to the interests of the professional, scientific and technical employees of the Dominion Government. Mr. Burley rendered valuable service during the organization period and as a member of the Executive, did much to forward the successful establishment of this institute.

Mr. Burley was elected an Associate Member of *The Engineering Institute of Canada*, 1909, and Member in 1919, and since his transfer to Ottawa he took an active interest in the proceedings of the local Branch.

In a telegram of sympathy to the late Mr. Burley's parents the Honourable Sir James Lougheed, Minister of the Interior, said: "He was one of the most valued officers of our department and enjoyed the esteem of all his associates. They will deeply mourn his death." Sir James aptly voiced the feeling throughout the Department both in Ottawa and in the West. The many friends of Mr. Burley will wish to associate themselves with this expression of loss and tender to his parents their heartfelt sympathy in the sad bereavement that they have suffered.

John Langton, M.E.I.C.

John Langton, M.E.I.C., was born at Toronto, Ont., on August 29th, 1857. He was a student in the Engineering Course at Owens College, Manchester, England, from 1873 to 1875, holding the Ashbury Engineering Scholarship.

In 1876-77, he served as an apprentice in the drafting room and machine shop of the Portland Company, at Portland, Me., and in 1879-80, in the machine shops of the Northern Railway, at Toronto.

In June, 1882, Mr. Langton joined the forces which Thomas A. Edison was then organizing for the introduction of his electric lighting system, and was later made superintendent of the Brooklyn shops. He was then transferred to Schenectady, N. Y., serving as superintendent of the Testing, Armature Winding, and Electric Tube Departments, but a little later he became chief engineer of the Edison Machine Works. This led to his selection, in May, 1889, as general manager of the Canadian Edison Manufacturing Company, at Sherbrooke, Que., and when that concern was consolidated, in 1890, with others to form the Edison General Electric Company, he was made manager of the Canadian Works. The rapid growth of the Edison system in the Dominion led to the removal of these works, in May, 1891, to much larger shops at Peterboro, Ont., Canada, where the plant has since remained, bearing to this day the imprint of Mr. Langton's remarkable engineering and constructive skill. He was tired out, however, by such continuous and strenuous application, and, in June, 1892, resigned his position with the Edison Company to take up private practice.

Mr. Langton became a member of the Canadian Society of Civil Engineers in December, 1892. He also served very acceptably in 1896. 1897, and 1898, as an Examiner for post-graduate degrees of M. E. and E. E., for the University of Toronto.

Mr. Langton's work in the mining field constitutes a chapter by itself. From 1900 to 1904, he was engaged in the design and construction of the entire smelting plant for the Copper Queen Consolidated Mining Company, at Douglas, Ariz. In 1904-05, came the installation of the generating plant, transmission line, and rotary converter sub-station for the mining plant of the Moctezuma Copper Company at Nacozari, Sonora, Mexico. In 1906-07, Mr. Langton installed approximately 450 beehive under-flue coke ovens at the plant of the Dawson Fuel Company, at Dawson, N. Mex., where the waste heat gases from the ovens are used to generate steam. In 1908, jointly with Mr. C. Legrand, he carried out the design and construction of a complete power plant of three 1,000-kw. turbines for the Moctezuma Company, and a combined turbine and compressed air plant for the Copper Queen Mines at Bisbee, Ariz.

In 1908, he went back to private practice, and since that time he had remodeled the power plant of the Cananea Consolidated Copper Company and supervised the design of the power plant of the Inspiration Copper Company, comprising two 6,000-kw. turbines and several blowing engines. In conjunction with Mr. F. L. Antisell, he had designed a large addition to a Raritan copper refinery.

Mr. Langton had the true scientific mind, that knows when a thing is proved and does not rest until it is, and his knowledge was scholarly and accurate.

That he was singled out for participation in the swift and startling developments of the formative days of electrical engineering, or the rough and tumble application of scientific advances to the crude conditions of frontier mining, was due to the extraordinary thoroughness and accuracy of thought which distinguished all his work; qualities of which daring promoters, in new fields, felt the need at their back. One feat of his, that has been quoted, was the erection in Arizona of a million dollar steel smelter, of which the material, prepared in Pennsylvania from his drawings and figures, fitted together exactly, so that not a beam or boring had to be altered in all the work.

Mr. Langton was a great reader and left a considerable library, but he liked companionship and was a most sympathetic and understanding companion.

PERSONALS

M. Brodie Atkinson, M.E.I.C., is at present on the engineering staff of the Welland Ship Canal.

*

J. Whitelaw, A.M.E.I.C., has been transferred from the Canadian National Railways to Toronto.

*

R. T. Gent, M.E.I.C., is at present with the New York Trap Rock Corporation at Peekskill, N.Y.

*

W. A. M. Cook, A.M.E.I.C., is at present structural engineer with the Board of Education at Toronto.

*

R. B. Jennings, A.M.E.I.C., has been transferred by the Canadian National Railways to Ottawa.

*

L. F. Merrylees, Jr.E.I.C., has joined the staff of the Northern Construction Company at Vancouver, B.C.

*

L. C. Charlesworth, M.E.I.C., has been appointed deputy minister of railways and telephones for Alberta.

*

C. K. McLeod, A.M.E.I.C., has accepted a position with The Phoenix Bridge & Iron Works Ltd., Montreal.

*

R. O. Stewart, A.M.E.I.C., has been appointed assistant engineer of standards, Canadian National Railway, Toronto.

*

W. A. Hendry, A.M.E.I.C., has been appointed chief engineer of the Highways Commission for the Province of Nova Scotia.

*

William A. Duff, M.E.I.C., has been appointed engineer of standards, Canadian National-Grand Trunk Pacific Rlys., Toronto.

*

J. Clark Keith, A.M.E.I.C., has been appointed chief engineer of the Essex Border Utilities commission, the appointment to take effect July 1st.

T. U. Fairlie, A.M.E.I.C., railway expert for the Ontario Hydro-Electric Commission is engaged on the valuation of the Ottawa Electric Railway.

*

F. K. Searancke, Jr.E.I.C., is at present with the Public Works Department at Kuala Lumpur, Federated Malay States, being engaged as assistant engineer.

*

William Verner Taylor, M.E.I.C., who has been assistant chief engineer of Quebec Harbour Commission for some years, has been appointed city engineer at Sarnia, Ont.

*

Fred. M. Brickenden, A.M.E.I.C., has opened an office in the London Loan Building, London, Ont., as a specialist in bridges, reinforced concrete, municipal engineering.

*

C. McN. Steeves, M.E.I.C., formerly with the Department of Soldiers' Civil Re-Establishment, St. John, N.B., has accepted a position with D. C. Burpee & Son, Edmundston, N.B.

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D. G. Calvert, A.M.E.I.C., until recently with the Fort William Paper Co., is now resident engineer at the Fort William office of the Management Engineering and Development Co.

*

H. K. Wicksteed, M.E.I.C., who has recently been absent from Canada for some months on a business trip to South America has recently returned to Canada and is at present in Toronto.

*

O. G. Gallaher, A.M.E.I.C., who has been one of the most active Institute members in Kamloops, B.C., has accepted a position with the Miami Corporation and is now at Fort Haney, B.C.

*

C. E. Macdonald, A.M.E.I.C., recently gave an illustrated address before the Ontario section of the American Society of Mechanical Engineers on mechanical process in mining and metallurgy.

*

Edgar Stansfield, M.E.I.C., has accepted a position as research engineer in fuels with the Provincial Government of Alberta. He is now engaged in equipping his laboratory in the Industrial Research Department of the University of Alberta, Edmonton.

Francis Hankin, A.E.I.C., has been awarded a special prize for highest standing in common law at McGill University. Mr. Hankin has undertaken the study of law while engaged in many other business activities and this achievement is particularly noteworthy.

*

T. J. Brown, M.E.I.C., until recently superintendent, Calgary Division, Western District, Canadian National Railway and Grand Trunk Pacific Railway, has been appointed superintendent Dauphin Division, Prairie District, Canadian National Railway and Grand Trunk Pacific Railway.

*

O. S. Finnie, B.Sc., D.L.S., A.M.E.I.C., has been appointed administrator of the Mackenzie District, including the new oil fields of that Territory.

*

J. A. Duchastel, M.E.I.C. was elected president of the Montreal Division of the Automobile Club of Canada at a meeting held on May 3rd. H. H. Vaughan, M.E.I.C. was elected vice-president at the same meeting. The Montreal Division of the Automobile Club of Canada has had an exceptional successful year and under the leadership of two Institute members should go forward to further successes.

*

George A. Johnson, M.E.I.C., has formed partnership with Messrs. Nelson B. Wolfe, Harold C. Stevens and Charles R. Wyckoff, succeeding the firm of Johnson and Benham, Inc., under the name of George A. Johnson Company, Inc., with offices at 150 Nassau Street, New York. The George A. Johnson Company will undertake consulting work in connection with water supply, electric light, industrial plants, etc.

*

Arthur Crumpton, M.E.I.C., valuation engineer of the Grand Trunk Railway System, Montreal, was elected President of the Canadian Railway Club, at its annual meeting held in Montreal on the 10th instant. The Canadian Railway Club is a live institution, embracing 1385 members, representative of every department of railway service, and its papers and discussions are invariably of considerable interest and value.

*

Elected to Senate, University of Alberta

A. S. Dawson, M.E.I.C., chief engineer, Dept. of Natural Resources, Canadian Pacific Railway Co. of Calgary, Alberta, has recently been elected to the Senate of the University of Alberta as representative of the Association of Professional Engineers of Alberta.

Mr. Dawson was born at Pictou, Nova Scotia, in 1871, and graduated from the Applied Science faculty of McGill University in 1894 with the degree of B.A.Sc.

During 1894-97 he was engaged in hydraulic work in Massachusetts. In 1898, he joined the Maintenance of Way staff of the Can. Pac. Ry. at Winnipeg, and was engaged in railway work until 1903, at which time he filled the position of chief engineer of the Western Division of the Railway Company.

In 1903 he changed the line of his endeavours to irrigation work, and since that time he has had charge of the construction and operation of all the Can. Pac. Ry. Co's irrigation systems in Alberta.

A. S. DAWSON, M.E.I.C.

Mr. Dawson has been a member of *The Engineering Institute of Canada* since 1895—and of the American Society of Civil Engineers since 1912.

He has also been activily interested in educational and civic affairs; having been at different times a member of the Calgary School Board, of the Executive of Western Canada College, of the Council of the Calgary Board of Trade, of the Board of Directors, Y.M.C.A., of the Executive Calgary Automobile Club, and of the Executive of the Alberta Good Roads Association.

He was married in 1898 to Martha Elenora Bonn of Baltimore, Md., and has one son who has just completed his second year in Applied Science at the University of Alberta.

Appointed Commissioner of Public Works for the City of Edmonton, Alta.

C. J. Yorath, A.M.E.I.C., has recently been appointed commissioner of public works and utilities and joint commissioner of finance of the City of Edmonton; this appointment is a logical outcome of Mr. Yorath's wide experience in municipal work. Mr. Yorath was born at Cardiff, Wales, in 1879, was articled to James Allan, engineering contractor at Cardiff and was appointed assistant to city engineer at Cardiff in 1900. In 1903 he received an appointment of deputy engineer at Acton, London, and remained in Acton until 1910, engaged in construction of incinerator, main drainage, roads, bridges and other important municipal work. After two years experience as Professor in municipal and administration work at Westminster, London, employed upon main drainage work at Acton, under Sir Alex Binnie, Mr. Yorath came to Canada to take the appointment of city commissioner of the City of Saskatoon. During the tenure of this appointment Mr. Yorath reorganized the administration and readjusted finances of the City, also investigated and reported upon finances of the City of Prince Albert and of the Town of Humboldt.

C. J. YORATH, A.M.E.IC.

In addition to being an Associate Member of *The Engineering Institute of Canada*, he is a Member of The Institution of Civil Engineers (Great Britain), Member of the Royal Sanitary Institute, England. Member of the Town Planning Institute (Canada).

He is the author of brochures on Town Planning, Main Drainage, Housing, Municipal Administration and Finance, Road Making, Incinerators, etc.

New Toronto Councillor

Professor C. R. Young, M.E.I.C., is well known to members of *The Institute* and engineering profession in the Dominion, his work both as Associate Professor of Structural Engineering in the University of Toronto, in private consulting practice and in technical writing being of outstanding value.

Professor Young was born in February 1879, near Picton, Ont., educated at Picton High School and in the Faculty of Applied Science and Engineering of the University of Toronto, graduating with honours in civil engineering in 1903. He completed a post-graduate course in 1905, and in 1914 received the professional degree of C.E. After graduation he was for two years in the detailing department of the Dominion Bridge Co., Ltd., Lachine, then resident engineer and engineer in charge of location parties for the Toronto and York Radial Railway, and later draughtsman, checker, designer and estimator in the bridge department, Canada Foundry Co., Toronto. In the summers of 1907 and 1908 he was with Smith, Kerry and Chace, consulting engineers, Toronto, in charge of bridge and transmission line tower designs and resident engineer on mill construction. In October 1907 Professor Young was appointed lecturer in structural engineering at the University of Toronto, and since that date has been advanced to assistant professor and later associate professor.

PROFESSOR C. R. YOUNG, M.E.I.C.

Professor Young was on active service in Canada during the war with the rank of Major, from February 1916 to April 1919, first as adjutant school of infantry, M.D. No. 2, and later as second in command, Polish

Army Camp, Niagara-on-the-Lake, where 21,000 Poles were mobilized, given preliminary training and despatched to Europe. He was decorated by the Government of France for services in connection with the Polish contingent.

In private practice Professor Young was at first a member of the firm of Barber and Young, but this partnership was later dissolved. He has been a frequent contributor to technical press and is an author of booklets: "Structural Problems", and "Principles of Specification and Agreement Writing".

*

New Administrator of Mackenzie District

O. S. FINNIE, B.Sc., D.L.S., A.M.E.I.C.

O. S. Finnie, A.M.E.I.C., has been appointed administrator of the new oil territory on the Mackenzie River. The position to which Mr. Finnie has been appointed is one of importance, being practically governor of this great territory. Mr. Finnie's staff will include engineers and a detachment of the Royal Canadian Mounted Police.

Mr. Finnie's party of 25 left Peace River Landing in scows on the 5th May, with supplies and equipment. Mr. Finnie is leaving Ottawa in the course of a day or two and will overtake his party on the Smith Portage. The probability is the Mining Recorder's Office will be temporarily established at Fort Smith, and Sub-Recorders at Norman or any other points necessary. These matters will be entirely in Mr. Finnie's hands; in addition to which he will take the census of that District, also make an examination of the various settlements, with a view to the erection of Radiotelegraph posts; undertake the demarcation of channels at various points along the river and the installation of buoys and beacons; a general inspection of the Oil Wells and the suitability of the country for the installation of a Pipe Line. Mr. Finnie, and many of his party, will return before the close of navigation but will leave, to spend the winter in that country, as many officers as are necessary to adequately take care of Government business.

Mr. Finnie is a member of the Managing Committee, Ottawa Branch, and chairman of the Sub-committee on membership.

Lethbridge Engineering Meeting

Contributed

An enthusiastic meeting of engineers greeted Secretary Keith on his visit to Lethbridge, Alberta, Saturday evening, April 16th. There being no branch of the E.I.C. at Lethbridge, Mr. Keith had not included that point in the itinerary of his Western trip, but upon the solicitation of Sam G. Porter, Member of Council E.I.C. and other members of *The Institute* located at Lethbridge, he changed his plans so as to spend one afternoon and evening with them. Points of interest were visited in the afternoon and in the evening a dinner was arranged at the Y.M.C.A. where thirty-four engineers gathered to meet and hear Mr. Keith. Sam G. Porter, M.E.I.C., occupied the chair. The meeting was livened up by some chorus singing led by a few of the local Rotarians who are also engineers.

Mr. Keith after congratulating Lethbridge on the distinction of having a board of City Commissioners composed entirely of professional engineers, gave an elaborate explanation of the objects and activities of *The Engineering Institute of Canada.* His address made a lasting impression on all present and it seemed to be the unanimous verdict that a Branch should be formed in Lethbridge next fall.

George G. Anderson, Director, M.E.I.C., of Los Angeles was present and gave a brief address in which he praised very highly the progressive policy of the E.I.C., and the splendid work it was doing under Mr. Keith's able direction.

A general discussion followed Mr. Keith's address in which Mayor Hardie, Major Muckleston, Commissioner Meech and others took part.

The following is a list of those who were present:—

Mjr. H. B. Muckleston, M.E.I.C.. ch. engr. Lethbridge Northern Irrigation District; C. M. Arnold, M.E.I.C., principal asst. engr., Lethbridge Northern Irrigation District; P. M. Sauder, M.E.I.C., divisional engr., Lethbridge Northern Irrigation District; F. S. Dyke, A.M.E.I.C., divisional engr., Lethbridge Northern Irrigation District; H. G. Cochrane, A.M.E.I.C., resident engr., Lethbridge Northern Irrigation District; C. L. Dodge, J.M.E.I.C., resident engr., Lethbridge Northern Irrigation District; G. F. Hilliard, resident engr., Lethbridge Northern Irrigation District; E. H. Ings, draftsman, Lethbridge Northern Irrigation District; A. Thompson, draftsman, Lethbridge Northern Irrigation District; C. D. MacKintosh, A.M.E.I.C., supt. Lethbridge Division, C.P.R.; H. R. Miles, M.E.I.C., divisional engineer, Lethbridge Division, C.P.R.; W. D. L. Hardie, mining engr., Mayor of Lethbridge; H. W. Meech, A.M.E.I.C., Commissioner of public works, Lethbridge; M. Freeman, commissioner public utilities, Lethbridge; J. Haimes, asst. engr., City Hall, Lethbridge; H. M. Whiddington, architect, Lethbridge; John Dow, supt. of plant, Lethbridge District

Alta. Government Telephones; H. P. Keith, D.L.S., A.L.S., district surveyor, Dept. Public Works; W. Meldrum, mining surveyor, Galt Mines, Lethbridge; J. H. Turner, mining surveyor, North American Collieries; Robt. Livingston, supt. Galt Mines, Lethbridge; S. G. Porter, M.E.I.C., supt. oper. and mtce. C.P.R. Irrigation System, Lethbridge; Charles Raley, office engr. C.P.R. Irrigation System, Lethbridge; G. S. Brown, Jr.E.I.C., asst. engr. C.P.R. Irrigation System, Lethbridge; D. G. McCrae, canal superintendent C.P.R. Irrigation System, Lethbridge; M. F. R. Lloyd, canal superintendent, C.P.R. Irrigation System, Lethbridge; R. S. Lawrence, A.M.E.I.C., watermaster C.P.R. Irrigation System, Lethbridge; H. W. Rowley, watermaster C.P.R. Irrigation System, Lethbridge; W. L. McKenzie, electrical engineer, dealer in electrical supplies; George Fleming, City Hall staff; F. A. Wallace, formerly resident engineer, Canada Land and Irrigation Company; N. H. Bradley, D.L.S., A.L.S.; George G. Anderson, M.E.I.C., M.A.S.C.E., (Director) consulting engineer, Los Angeles, California; Fraser S. Keith, A.M.E.I.C., Secretary, *Engineering Institute of Canada*, Montreal.

First General Meeting of Committee on Concrete Deterioration in Alkali Soils.

The Meeting was called to order by Chairman Mackenzie, at 2.30 P.M., April 23, 1921, in the Engineering Building at the University, the following visitors and members being present:—

Mr. Brereton, Mr. Craig, Mr. Dawson, Mr. Finlayson, Mr. Haddow, Mr. Keith, Mr. Kelso, Mr. Mackenzie, Mr. Weir, Mr. Williams. Mr. Williams was designated to act as Secretary to the Committee.

After discussion on Reports relative to the status of funds, the resignation of Mr. Alexander, committee member from Alberta was accepted and it was agreed that in this case and future vacancies that nominations to fill vacancies be made by members from the province concerned. The Alberta Committee later recommended that the Chairman request the appointment of Mr. Kelso to fill this vacancy.

A general discussion of the policy of the Committee and the scope and extent of the proposed investigation followed. It was agreed that no extensive field investigation which would duplicate past work should be undertaken. A limited amount of field work will be desirable at the start of the investigation, but it was agreed that immediate steps should be taken to get the Chemical Research work underway. The field work will then be enlarged as definite results of chemical research are available for test in the field.

In connection with the selection of a properly qualified chemist to conduct the chemical research work the Chairman was requested to write to the Research Council asking for suggestions as to the names of suitable men to conduct this work. This appointment will cover a period of three years with headquarters at the University of Saskatchewan.

In connection with the limited field work which will be done during the summer months of the first year Mr. Williams was designated to take charge as field engineer.

A motion by Mr. Craig that an Executive Committee made up of the Chairman of each provincial committee be formed the Chairman being authorized to act for their respective branch committees.

The executive committee includes Messrs. Dawson, Finlayson and Mackenzie.

The matter of carrying on the necessary routine Chemical analyses in connection with the field work was left to the executive for action.

The programme for field tests will also be referred to the executive before field work is started.

A discussion as to method of making public results which may be obtained brought out the fact that such reports must first go to *The Institute* for publication in *The Journal.*

It was agreed that it would be desirable to have as full members of the committee several of the chemists of the three provinces who have been interested in the Alkali-Concrete problem and the Chairman was requested to recommend the appointment of Messrs. Field, Blackie, Thorvaldson and Shipley.

A motion by Mr. Dawson was passed providing for two Committee meetings per year, about April and November and such special meetings as may be necessary. The executive is to meet at the call of the Chairman.

It was agreed that committee members be reimbursed for actual travel expenses incurred in attending meetings.

The meeting adjourned at 5.30 P.M.

C. J. MACKENZIE, M.E.I.C.,
Chairman.

G. M. WILLIAMS, A.M.E.I.C.,
Secretary.

City of Regina

Tenders for Construction of Humus Tank

Sealed Tenders addressed to the City Commissioners City of Regina, will be received up until 10:00 o'clock (Standard Time) June 10th, for the construction of a reinforced concrete Humus Tank at the City Sewage Disposal Works.

The work includes approximately 5000 Cu. Yds. of excavation and 500 Cu. Yds. of reinforced concrete together with the placing of pipes, valves, etc.

A deposit of Ten Dollars ($10.00) will be required for each set of Plans and Specifications taken away, which deposit will be refunded upon the receipt of a bona-fide tender together with the return of the Plans and Specifications.

All information, Plans, Specifications and Form of Tender may be had from the City Engineer.

The City Commissioners reserve the right to reject the lowest or all tenders.

D. A. R. MCCANNEL, A.M.E.I.C.
City Engineer.

May 17th, 1921.

BRANCH NEWS

Victoria Branch

H. M. Bigwood, A.M.E.I.C., Secretary.

It was with particular pleasure that members of the Branch were able to welcome Mr. Keith on the occasion of his recent visit to the coast and to Victoria, and everyone looked forward to an opportunity to discuss with him matters affecting *The Institute* and the Profession at large.

The dates allocated to Victoria were Monday, Tuesday and Wednesday, April 6, 7 and 8, a luncheon to be held on the first day and a regular meeting of the members on the last, the intervening time to be used in affording the visitor time to visit individual members and also places of interest near at hand.

Both the meetings were very well attended and the discussions showed that a very real interest was being taken in *The Institute,* this was especially the case at the Wednesday meeting when the subject of remuneration was fully dealt with. The discussion clearly showed the importance attaching to the subject, and hope was expressed that *The Institute* would be able at an early date to publish a schedule of salaries which would form a basis upon which to base requests for re-adjustments. Instances were cited where members with considerable experience were only receiving bare living salaries quite out of proportion to the years spent in education and training.

Mr. Keith spent considerable time with the local member of Council, H. L. Johnston, M.E.I.C., the Secretary of the branch and the Executive, and considerable benefit must have been derived from the very full and free discussions.

At the luncheon E. A. Cleveland, M.E.I.C., and N. A. Yarrow, A.M.E.I.C., expressed the welcome of the Branch, the Chairman of the branch, E. G. Marriott, A.M.E.I.C., presided.

The Branch is eagerly awaiting the visit, stated by Mr. Keith to be imminent, of the President, J. M. R. Fairbairn, and the Treasurer, Brig.-Gen. Sir Alex. Bertram, the occasion of their visit will be the last events of the Branch for the season, except that several visits will be made to points of interest during the summer.

Buzzings

A certain railway bridge had been destroyed by fire, and it was necessary to replace it without delay. The bridge engineer and his staff were ordered in haste to the place. Two days later the superintendent of the division came along. Alighting from his private car, he encountered the old master bridge builder.

"Bill," said the superintendent, "I want this job rushed. Every hour's delay means a serious loss. Have you the engineer's plans for the bridge?"

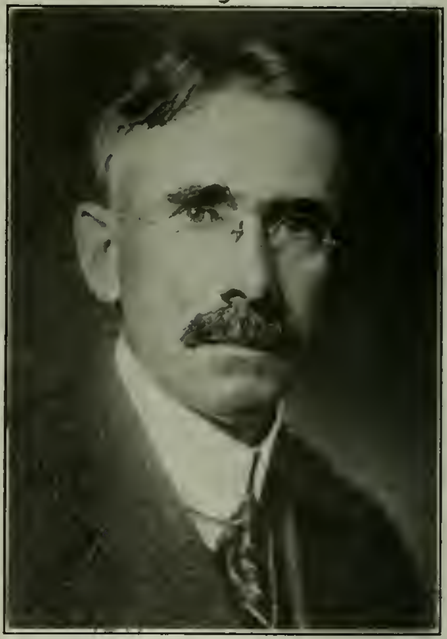
"I don't know," replied the grizzled old bridge builder, "whether the engineer has the picture drawed yet or not, but the bridge is up and the trains is passin' over it as usual."

Calgary Branch

Arthur L. Ford, M.E.I.C., Secretary-Treasurer
Floyd K. Beach, A.M.E.I.C., Branch News Editor

Gavin N. Houston, M.E.I.C., has submitted his resignation as Chairman of the Branch effective May 15th, on his leaving Calgary for Lethbridge as secretary of the provincial Irrigation Council.

Mr. Houston's resignation is received and accepted with regret, as his occupancy of the chair has been accompanied by much constructive activity in the Branch. He has shown a happy faculty of getting a maximum number of members working actively and harmoniously in various lines of effort. One outstanding constructive feature of his period of office was a revision of the Branch by-laws. While the new by-laws have not yet been formally passed, they have passed a meeting of the Branch in open discussion, at which Mr. Houston very tactfully brought the views of the members present to agreement.



GAVIN N. HOUSTON, M.E.I.C.

Mr. Houston came to Canada with a wealth of experience in various lines of engineering work. He has held a variety of construction and administrative positions, chiefly in irrigation, water works and sewerage projects. As deputy state engineer he had a valuable administrative experience in handling irrigation interests and he was for several years in private practice in Colorado, reporting on several large and a number of small irrigation projects.

As chief field engineer for the Irrigation Branch of the Department of the Interior, and later as assistant commissioner of Irrigation and as acting commissioner, he has become widely and favourably known to Irrigation circles in the provinces of Alberta and Saskatchewan, while his published papers in the proceedings of the American Society of Civil Engineers, of which he is Member, have made his name familiar to engineers throughout the United States.

New Chairman

To complete the term of office as Chairman of the Branch left vacant by Mr. Houston's resignation, the executive Committee have named B. L. Thorne, M.E.I.C.

Mr. Thorne is a mining engineer of wide experience and his appointment as Chairman is very favourably received by the membership of the Branch. His engineering career started in 1894 when for three years he was engaged in land survey work in northern Ontario. This work took him into the mining districts and he took up active mining work about 1897. After following this work for a time he took a course in assaying and resumed work in charge of assaying and exploration for various gold mining companies. After following metal mining in Ontario, Colorado and Arizona for a number of years he accepted the post of engineer for the C.P.R. Coal Mines Branch of the Department of Natural Resources in 1903 and has held that post up to the present. During this time he has been in active charge of several large coal mine developments, including both underground developments and the construction of buildings, coke ovens, tracks, etc.

He is a member of the American Institute of Mining and Metallurgical Engineers, a Councillor of the Alberta Association of Professional Engineers, and Secretary of Rocky Mountain Branch of the Canadian Institute of Mining and Metallurgy.

Branch News Committee

Acting on a recommendation of the Secretary, the Executive Committee appointed the following as an editorial committee to collect Branch News for *The Journal:—*

Floyd K. Beach, A.M.E.I.C., Chairman.
C. M. Arnold, M.E.I.C., Lethbridge.
G. P. F. Boese, A.M.E.I.C., C. P. R. Natural Resources.
A. S. Chapman, A.M.E.I.C., City Hall.
G. H. Patrick, A.M.E.I.C., Strathmore.
B. L. Thorne, M.E.I.C., Mining.
R. S. Trowsdale, A.M.E.I.C., Electrical and Mechanical.

Successors to Irrigation Posts

Victor Meek, A.M.E.I.C., succeeds Gavin N. Houston, M.E.I.C., as acting commissioner of irrigation, and P. J. Jennings, M.E.I.C., takes the post of acting assistant commissioner of Irrigation.

Mr. Meek is a graduate of McGill University and has been on the staff of the Irrigation office since 1912. He served overseas as an officer in the Canadian Engineers, 2nd and 3rd Tunnelling Companies where he was seriously wounded and invalided back to Canada. On regaining his strength he resumed his duties with the Irrigation office in charge of a survey party and later as office engineer in charge of personnel and of records obtained by a number of large parties. His appointment as acting commissioner is a recognition of some years of very valuable service to the public in the work of acquiring data to facilitate irrigation development.

P. J. Jennings, M.E.I.C., came to the Irrigation office in 1911 with experience in irrigation and general engineering gained in England, Canada and South Africa. He has held the post of office engineer for some 8 years administering domestic and industrial water rights and the many small irrigation schemes. During the war he served with the Royal Engineers in German East Africa with rank of Major and was awarded the O.B.E.

Irrigation Legislation

At the session of the Alberta Legislature recently closed, an act was passed which will have momentous bearing on the development of irrigation in the province.

Previous acts have provided that localities desiring irrigation may form themselves into corporations having power to construct canals and ditches, acquire water rights and distribute water to the members of the district.

However, owing partly to previous failures of some districts to make a financial success, and partly to the general difficulty of securing capital, districts otherwise in shape to go ahead with much needed development have failed to secure funds. The act just passed permits the province to guarantee the bonds of districts and provides certain safeguards, the principal one being that an Irrigation Council, consisting of three members will have the duty of advising every board governing an irrigation district upon the conduct of its affairs. The members constituting the Council shall be appointed by the Lieutenant-Governor in Council and it is interesting to note that in the case of the Existing Council there are already appointed two members of *The Engineering Institute of Canada*, L. C. Charlesworth, M.E.I.C., Chairman, and G. N. Houston, M.E.I.C., Secretary.

The Council has very extensive powers over the expenditure of funds and in connection with the construction of works in fact, no contract for the construction of any work whatever can be entered into by the Board until the same shall have received the assent of the Council.

Another most interesting feature of the Act is that making it obligatory on the board of an irrigation district when appointing an engineer that he be a registered professional engineer of Alberta.

While the legislation previously passed affecting the profession does not give all that may be wished, the requirement above noted for engineers of irrigation districts is felt to be a step in the right direction. The above legislation has made possible an active construction programme this year for the Lethbridge Northern Irrigation District. Tenders have been called for and the contracts will probably have been let by the time this appears.

H. B. Muckleston, M.E.I.C., is chief engineer.

Winnipeg Branch

Geo. L. Guy, M.E.I.C., Secretary-Treasurer.

On the 28th April, at the regular meeting of the Branch, a paper was read by F. H. Martin, M.E.I.C., on Electric Furnaces.

Mr. Martin dealt very fully with the different types of furnaces which had been developed for Ferrous and Non-Ferrous metals, describing in detail the various claims made by the various types of furnaces. He also showed cost curves for operating and labour costs on electrical furnaces. He dealt briefly on electrolytic furnaces and with a description of other work for which electric furnaces could be adapted, such as annealing, glass making, etc., and finished with a very interesting description of a proposed electric furnace for making bricks. The paper was profusely illustrated with lantern slides and diagrams and was listened to with great interest by the members.

After Mr. Martin's paper, W. C. Taylor, A.M.E.I.C., gave a short address which might be described as "Taxation as an Engineer's Problem" and by means of graphs illustrated some of the fallacies which are now being exploited so much by certain classes of politicians. His exposure of the fallacy of the Single Tax scheme as a fair and equitable taxation was particularly interesting and brought out vividly the advantages of scientifically investigating taxation schemes and analysing their merits. He wound up his address with a humorous talk on the amount of lost energy in the debates of the City Council and members of the Legislature and suggested that we had there a wonderful opportunity for the conservation of energy.

Fraser S. Keith, Secretary of the Institute, then addressed the meeting, outlining the work of Council and laying particular stress to the work of the Policy Committee of *The Institute* and to the results which had been obtained in Legislation through the Dominion. He also touched briefly on the question of a uniform salary schedule and strongly emphasized the necessity for proper co-operation between engineers if a schedule were to be made of any benefit to the profession.

Among the business done was a motion instructing the Secretary to write a letter of appreciation and good wishes to A. W. Smith, A.M.E.I.C., late Secretary of the Branch, who is leaving Winnipeg for Toronto, and to Mr. Burbridge, A.M.E.I.C., who is also leaving.

The Secretary introduced one bright spot in the lives of the members when he informed the meeting that the legal advisors of the Association of Professional Engineers of the Province of Manitoba had stated that engineers were entitled to deduct from their Income Tax Assessment dues paid to *The Institute*, dues paid to the Association of Professional Engineers of Manitoba, moneys paid for periodicals, 5% of the value of their library and 10% of the value of all instruments used in their profession.

The meeting closed with a hearty vote of thanks to Messrs. Martin and Taylor for their interesting papers.

*

Fraser S. Keith, General Secretary, who has been visiting the Branch, arrived in the City on the 25th instant. On the 28th instant W. M. Scott, M.E.I.C., Chairman of the Branch, entertained Mr. Keith and members of the executive to an informal luncheon at the St. Charles Hotel. On Friday, the 29th instant, a formal luncheon was tendered to Mr. Keith at the Ft. Garry Hotel. Mr. Keith addressed the members on the general policy of *The Institute*, outlining the work of the various Committees, and expressed his pleasure at the live interest he found among the members of the various Western Branches. The luncheon was largely attended and it was felt by all that the visits of the Secretary of the Branch were a great help in binding together the various Branches and in inspiring the members to further efforts in the betterment of the status of the profession, which can only be done by close co-operation of all the engineers, the logical medium being *The Engineering Institute of Canada*, and it is hoped that these visits will be made at least an annual event.

*

The City Council at its recent meeting voted $200.00 to the Branch of *The Institute* for research into the action of alkali on concrete.

Niagara Peninsula Branch

R. P. Johnson, A.M.E.I.C., Secretary-Treasurer.
G. R. Taylor, A.M.E.I.C., Branch News Editor.

General Conditions in the Niagara Peninsula

In common with the rest of the country this district has been adversely affected by the trade depression and most of the industrial plants are working with reduced staffs or on short time, and in some cases have closed down altogether. The work on the Queenston-Chippawa Development employing about 7000 men and on the Welland Ship Canal employing about 2000 men has helped to solve the unemployment problem. Apart from these two works there is very little engineering work going on in the district. On the American side the Niagara Falls Power Co. have commenced the construction of a 32 ft. horseshoe pressure tunnel under their present canal, designed to increase the capacity of their plants from 373,500 H.P. to 561,000 H.P.

Queenston-Chippawa Development

Progress on this work has been very satisfactory during the past winter and spring. The suction dredge Cyclone was rented from the Toronto Harbour Commission and commenced work in the Southern or earth section of the canal in March, moving North to meet the shovels, which are uncovering the rock. The earth excavation is very well advanced and there is now only one large shovel working in earth, while four are in rock as well as four of the smaller shovels. In June all the large shovels will be in rock and will remain there until the excavation is completed.

The concrete lining, which was commenced last November and continued throughout the winter is progressing satisfactorily and the special lining plants designed for this work have proved their value and have actually given a performance 15% to 20% better than was anticipated.

Work on the power house structure, which was also commenced last November has continued through the winter and is in an advanced state.

Peterborough Branch

R. L. Dobbin, M.E.I.C., Secretary-Treasurer.

The meeting of the Branch held on the 28th April was addressed by A. L. Killaly, A.M.E.I.C., superintendent of the Trent Canal, who gave a paper on the Regulation of the Run-Off from the Upper Trent Watershed, and the Possibilities of Further Conservation.

Mr. Killaly handled his subject well, and showing a number of convincing tables and charts as well as a large number of lantern slides, to illustrate his points.

There was a large attendance of members present, and also a number of visitors from outside points.

The annual meeting of the Branch was held on May 12th at which the ballots for the election of officers were opened and counted. The result was as follows:—

Honorary Chairman, R. H. Parsons, M.E.I.C., city engineer.
Chairman, P. L. Allison, M.E.I.C., dept. engineer, Can. Gen. Elec. Co.
Vice Chairman, P. P. Westbye, M.E.I.C., managing director, Wm. Hamilton Company.
Secretary, D. L. McLaren, A.M.E.I.C., assistant engineer, Can. Gen. Electric Co.
Treasurer, A. B. Gates, A.M.E.I.C., assistant engineer, Can. Gen. Electric Co.
Executive Committee: E. R. Shirley, M.E.I.C., H. O. Fisk, M.E.I.C., A. L. Killaly, A.M.E.I.C., G. R. Langley, M.E.I.C., Jas. MacIntosh, A.M.E.I.C., B. L. Barnes, M.E.I.C., R. L. Dobbin, M.E.I.C., Ex Officio.

E. R. Shirley, M.E.I.C., Chairman of the Meetings and Papers Committee gave his Annual Report as follows:

Annual Report

The occasion of our second annual meeting to-night marks another epoch in the history of the Peterborough Branch of The Engineering Institute of Canada.

We are glad to be able to review our year's work with satisfaction and to report a very successful season.

The meetings held were as follows:—

May 6th, 1920—Annual Meeting and Election of Officers.
Oct. 14th, 1920—Public Highways — Illustrated with motion pictures and lantern slides.
Speaker — Hon. W. A. McLean, M.E.I.C., Deputy Minister of Highways for Ontario.
Nov. 11th, 1920—Annual Banquet.
Nov. 25th, 1920—Electrification of Steam Railways — Illustrated with lantern slides.
Speaker — W. G. Gordon, railway and traction engineer for Canadian General Electric Co.
Dec. 9th, 1920—Present Researches on Super and Portland Cement — Illustrated with microscopic views and lantern slides.
Speaker — Capt. F. M. Dawson, A.M.E.I.C., Super Cement Co. of Canada.
Jan. 13th, 1920—Water Power Development on the St. Maurice River — Illustrated with lantern slides and moving pictures.
Speaker — P. S. Gregory, A.M.E.I.C., electrical engineer for Shawinigan Water & Power Co.
Feb. 10th, 1921—Reservoirs for Power and Water Supply—Illustrated with lantern slides.
Speaker — Wm. Gore, M.E.I.C., consulting engineer, Toronto.
Feb. 24th, 1921—The Welland Ship Canal — Illustrated with lantern slides.
Speaker — Alex. J. Grant, M.E.I.C., chief engineer Welland Ship Canal.
Mar. 10th, 1921—General Oil Refining Practice — Illustrated with moving pictures.
Speaker — C. D. Dean, A.M.E.I.C., construction engineer for Imperial Oil Co.
Mar. 24th, 1921—Pulp and Paper Making — Illustrated with moving Pictures.
Speaker — P. P. Westbye, M.E.I.C., general manager and chief engineer, William Hamilton Co., Peterborough.
Apr. 14th, 1921—Construction Methods used on Queenston Chippawa Development — Illustrated with lantern slides and moving pictures.
Speaker — A. C. D. Blanchard, M.E.I.C., chief field engineer, H.E.P.C. of Ontario.
Apr. 28th, 1921—Regulation of Run-off from Upper Trent Watershed and the Possibilities of Further Conservation — Illustrated with lantern slides.
Speaker — A. L. Killaly, A.M.E.I.C., superintendent of Trent Canal.
May 12th, 1921—Annual meeting and election of officers.
Address on Institute Affairs by Fraser S. Keith, M.E.I.C., General Secretary.

The average attendance for the season has been 51. This, you will note is a big increase over the previous season which was 42 and indicates that a lively interest is taken in the Branch and the papers which have been presented.

Papers and Meeting Committee,
E. R. Shirley, *Chairman.*

D. L. McLaren, A.M.E.I.C., Treasurer, gave his annual report showing a balance on hand of $14.59.

G. R. Langley, M.E.I.C., gave notice of motion to change the method of nominating the officers of the Branch.

Fraser S. Keith, General Secretary was present, and addressed the meeting on the Progress of *The Engineering Institute.* Mr. Keith described his recent trip to the West, and the enthusiasm displayed there. He also told of the changes within *The Institute*, and how it had evolved from a stiff technical society into energetic work for the individual. The Branches have played a great part in this evolution, and credit is due them for the progress thus far. Only a few years ago men at the bottom of the profession felt that those at the top, were not doing all that they could to advance it. On the contrary the men at the top are now willing to take off their coats, and advance the standing of engineers. The public generally is beginning to realize that the engineer is responsible for the fact that it has the benefits of civilization.

Mr. Keith asked for the support of the Branch for *The Journal* which was established to provide for an inter-communicating medium amongst the members.

The meeting concluded with a moving picture showing modern methods of manufacturing barrels, and refreshments in the shape of "hot dogs", doughnuts and coffee.

Ottawa Branch

F. C. C. Lynch, A.E.I.C., Secretary-Treasurer.

The City Council of Ottawa on 18th April, appointed a Town Planning Commission under the provisions of the Ontario "Planning and Development Act". The Commission consists of the Mayor ex-officio, two aldermen and four ratepayers, all serving gratuitously.

At the first meeting of the Commission Noulan Cauchon, A.M.E.I.C., was appointed Chairman. Mr. Cauchon was the originator of the planning of Ottawa and a pioneer in Canadian Town Planning. It is understood that one of the first things which will engage the consideration of the Commission will be the arterial highway and street system which greatly needs to be scientifically adjusted that development may proceed without hesitation.

The Engineering Institute and the Town Planning Institute will appreciate the recognition of professional status in the appointment of one of their members to the Town Planning Commission of Ottawa, and still further in his election to the chairmanship. Mr. Cauchon's well known enthusiasm to make our Capital unrivalled as a true expression of Canadian Nationality will claim their continued interest and sympathetic support.

*

E. E. Brydone-Jack, M.E.I.C., superintending engineer of the Federal Department of Public Works at Winnipeg, has been in Ottawa on business during the past two months. Mr. Brydone-Jack has been consulting with the Department on questions concerning the navigability of the Fraser River to New Westminster; drainage work in connection with Last Mountain Lake, Saskatchewan; The transportation questions to the MacKenzie River district by the Peace and Athabasca routes. The Department has recently added British Columbia to Mr. Brydone-Jack's territory and he will shortly be taking up his residence in that province.

*

Major-Gen. Garnet B. Hughes, M.E.I.C., arrived in Ottawa recently to visit his father, Sir Sam Hughes, who is seriously ill. Major-General Hughes was divisional commander of the 5th Canadian Division, and he had a distinguished record overseas. Since the war he has been engaged in business in England. It is understood that Major-General Hughes will return to England about May 21st.

G. J. Desbarats, M.E.I.C., B.A.Sc., C.M.G., deputy minister, Department of Naval Service, at the annual meeting of the Canadian Club of Ottawa was elected Chairman for the ensuing year. Mr. Desbarats succeeded C. A. Magrath, M.E.I.C.

*

Fuel Problems of Canada

Several members of *The Institute* have been called to Ottawa by the special committee of the House of Commons on Fuel. On May 10th the President of *The Institute*, Mr. Fairbairn, and a former member of Council, John Murphy, M.E.I.C., gave evidence upon the electrification of Canadian railways. On May 12th, R. A. Ross, M.E.I.C., Past-President of *The Institute* and Chairman of the Lignite Utilization Board, and Lesslie R. Thomson, M.E.I.C., engineer secretary of the same Board, informed the Committee respecting the progress already obtained in the briquetting of the lignites of Saskatchewan. On May 12th, H. E. M. Kensit, M.E.I.C., of the Dominion Water Power Branch, showed the Committee that water power was a fundamental question and intimately related to the fuel problems of the Dominion.

It is interesting to note that there was a professional engineer on this House Committee in the person of W. J. Blair, B.Sc., a member of the famous class of 1903 at 'Varsity.

Degree of LL.D. conferred on Charles V. Corless, M.E.I.C.

It is a source of gratification that Queen's University authorities have seen the light, — announcement having been made recently that the honorary degree of LL.D. would be conferred upon Charles V. Corless, M.E.I.C., M.Sc., (McGill), General Manager of the Mond Nickel Company, Coniston, Ont.

Mr. Corless is the sitting President of the Canadian Institute of Mining and Metallurgy, he is also named as President of the Provisional Council of the Association of Engineers in the Bill defining the status of the engineers resident in Ontario, which having reached its second reading was sacrificed with many other public measures at the sudden conclusion of the recent Legislature of the Ontario House.

'Varsity and Queens have both established the worthy precedent of appropriate recognition to the leaders in the engineering profession, what's the matter with "Old McGill".

*

A member of the Montreal Branch who was recently in Ottawa was asked to explain the Einstein theory. He explained it this way, — that recently on the train leaving his home city there were two more or less intoxicated men discussing the theory, and one asked the other what time it was. His friend fumbling for his watch in his pockets finally pulled out his match box and after pondering for some time announced that it was Thursday. His companion immediately in great excitement jumped up and said, "Gosh, I've got to get off here!"

Engineer Heads Purchasing Board

N. F. Parkinson, A.M.E.I.C., deputy minister of the Department of Soldiers' Civil Re-establishment, has been appointed commissioner of the Purchasing Commission of Canada, in which position he will act as director of the commission. No change is being made in the organization of the department of Soldiers' Civil Re-establishment, Mr. Parkinson continuing as acting deputy minister.

Except for a period of some six months, during which time Mr. Parkinson returned from overseas, he has been connected with the department of Soldiers' Civil Re-establishment in varying capacities since September, 1917. He was at first engaged in the vocational training branch in Toronto, later being transferred to Ottawa as assistant to W. E. Segsworth. On Mr. Segsworth's resignation, Mr. Parkinson was made director of voocational training, which position he held until he was appointed deputy minister of the department in April, 1920.

Labrador-Quebec Boundary

The dispute between Newfoundland and Canada respecting the boundary between Labrador and the Province of Quebec, is shortly to be heard before the Judicial Committee of the Privy Council in London. The case for Canada is being prepared by the Deputy Minister of Justice with the advice and assistance of James White, M.E.I.C. Mr. White is recognized as one of the outstanding authorities on all boundary matters affecting Canada, including both international and inter-provincial questions. Mr. White's assistance to Canadian Counsel in connection with the presentation of the Dominion's case in the Alaska boundary dispute was conspiciously capable.

Control of Lake of Woods Waters

Engineers generally will be interested in the fate of a rather unique and unusual type of legislation that has been provoking much controversy in legislative circles at Ottawa, Toronto and Winnipeg. The water powers of the Winnipeg river in the Province of Manitoba, having an ultimate capacity of over 500,000 horse power, of which over 85,000 horse power has already been developed by the City of Winnipeg and the Winnipeg Electric Railway Company, are very largely dependent upon the control factors in the upper waters of the Winnipeg and English rivers which happen to be situated in the Province of Ontario. These control factors are for the moment difficult of proper supervision because of international complications and lack of adequate domestic legislation. The international difficulties will in due course be overcome as soon as the Governments of Canada and of the United States formally agree to and definitely implement the recommendations of the International Joint Commission contained in its report respecting the Lake of the Woods Reference matter.

To meet the immediate needs in so far as domestic legislation is concerned, a Lake of the Woods Control Board Bill has been introduced at Ottawa and at Toronto which is unique in that it is concurrent and coterminous of the Dominion Parliament and of the Provincial Legislature of Ontario. This Bill contemplates the setting up a permanent Control Board consisting of four members "who shall be duly qualified engineers," two of whom shall be appointed by the Governor General in Council and two by the Lieutenant Governor in Council of Ontario.

The Bill comprehends giving this joint Board control over the regulation of the outflow from the Lake of the Woods and of the flow of the Winnipeg river between the Lake of the Woods and its junction with the English river, the control of the outflow from Lac Seul and of the flow of the English river above its junction with the Winnipeg river. The Bill also specifically provides that its authority may be extended to the supervision and the control of the use of these waters by the power developments on the lower Winnipeg river in the province of Manitoba.

On the face of it, the Bill is a simple, comprehensive, obviously necessary and appropriate piece of legislation. However, the private interests at the outlet of Lake of the Woods, who will be directly affected by the control desired to be vested in such a Board, have vigorously resisted the legislation both at Ottawa and at Toronto. The objections raised by these interests are, it is understood, very largely based on misunderstandings as to the real powers and prerogatives of the proposed Board, and it is not probable that such factious opposition will prevail. At the same time much controversial discussion has been caused as to the probable embarrassment which may be caused to international relationship as to respective Dominion and Provincial rights with regard to the confiscation of private property, all of which combined have caused both the Dominion and the Provincial Governments to postpone final action in connection with the Bill.

Apart from the unique features of the Bill, involving concurrent action of Parliament and of the Legislature, and aside from the vast water power properties directly affected thereby, the legislation has a special moment at this juncture to the engineering profession, as to which the attention of the members of *The Institute* should be specially drawn. The following apt wording is incorporated in section 2 of the Bill,—"there shall be a Board to be called the Lake of the Woods "Control Board, which shall consist of four members, *who shall be duly qualified engineers*." The fact that a provision of this kind can be inserted in a Bill and accepted by the Governments of Canada, Ontario and Manitoba with the consent of their expert legal advisers, is indeed a real evidence of the commanding position which the engineering profession is rapidly obtaining throughout Canada. Ten years ago the legal profession, which drafted all legislation, would probably have excluded such a provision as being unwarranted class legislation. J. B. Challies, M.E.I.C., and W. J. Stewart, M.E.I.C., have been appointed as consulting engineers to the Board: H. G. Acres, M.E.I.C., has been chosen as a representative of Ontario.

Montreal Branch Cartoons

He wants to see the
wheels go round,-

"My Gawd, - the damn
thing's got a "ground",

Just see those sparks
and hear that sound

The trouble never
will be found!"

Says -
Jim BURNETT!

Here he comes
in mighty state,

His new fur cap
chained fast behind,

For Duchastel has
met his fate,

And 'Outremont' fills
all his mind!

J. A.
DUCHASTEL

Charlie, Charlie,
up in the air,
What is it that you're
reading there?
Your bus is flying
far too fast,
Your charge of gas
will never last,
So shut the book
before you're ill,
You white-haired boy
of Old McGill!

Chas. M.
McKERGOW

My guardian angel
hovers near,
while I my work pursue.
I play with rivers—
see me now,
measuring one for you.
At other times—
at Polytech,
I govern all the boys;
And solemn tho
my face may
be, my life is full of joys,
I like to dance—
at tennis too,
I play with all the girls,
My family sees not
much of
me, because of all
these whirls!

Mon Ange gardien est
toujours près,
quand je travaille,
partout,
Les fleuves m'amuse,—
regardez moi,
mesurant un pour vous,
D'ailleurs—chez Ecole
Polytech,
je règne comme roi
enfin,
Et si je parais solennel,
ma vie des joies est
pleine,
J'aime bien danser—
au "jeu de paume",
aussi, je joue des fois,
Ma femme s'ennuie
de jour en jour,
parce que du manque
de moi.

Arthur SURVEYER

To catch all by-products
is industry's aim,

To fool all the people
is part of the game,

So "Mazola" from
corn cobs and starch
has been made,

And Jim Hunter of no
man is one bit afraid!

Here he stands,
right on the job,

Just watch him
grind another cob.

J. H. HUNTER

Another Beaver
engineer - our
President behold,

The E.I.C. & C.P.R.
he rules with
heart of gold,

He travels up and
down the land,

And makes new
friends on
everyland.

J. M. R. FAIRBAIRN

Who's this, you cry
with staring 'eye,—
When gazing at this
picture;
Why! dont you see,
its "K.B.T.".
Whithout one bit
of mixture.
His wires and volts
give people jolts,
When storms his
lines demolish,
But even then,
this prince of men,
Not once forgets
his polish.

K. B. THORNTON

Hydraulic erudi-
tion? - True.

Thermodynamic
learning too!

Literature he'll
quote for you,

And sell you
pumps when he
gets through.

John T.
FARMER

Robbie Ross' blood is Scotch

Mixed with electricity;

To take the job at City Hall

Seemed like eccentricity.

But engineering principles,

and his good sense of humour,

Have brought him farm—
His job's near done

With never one bad rumour.

R. A. ROSS

Here I sit in ghoulish glee,

Writing, writing feverishlee!

Send your money,
send your votes,

Pawn your hats, yes,
pawn your coats,

But pay your bills,
and come with me,

Each Thursday night to E.I.C.

J. L. BUSFIELD

The Silver-Tongued Orator of
the Westmount City Council

A sentence here —
a volume there,

You see them floating
through the air,

But getting no one anywhere!

Sometimes!

S. F. RUTHERFORD

On voit toujours l'ingénieur castor,
Gardien lui-même de son ouvrage,
Mais gagnant ni l'argent, ni l'or,
Comme Lefebvre-Duperron
si sages.

LEFEBVRE SELLING IT TO
POWER USERS

The beaver is an engineer,
Who guards his work for
him alone,
But gains not gold nor silver dear,
Like Lefebvre-Duperron here
shown.

O. O. LEFEBVRE.
A. DUPERRON.

Here's a conscientious fellow.
He looks as if be was quite 'mellow'
But no—the sewer from
which he smiles
Is only one of many miles.
That George MacLeod
must answer for
To City Hall and thousands more.
And were it not for such as he
From trouble we would
ne'er be free.
At obstacles he never wept
A finer fellow never stepped!

George R. MACLEOD

Three years ago old "W. J.",
At last from Council got his way,
And thereupon with "F.B.B.",
Produced a Branch of E.I.C.
Then Francis, father, and
Brown, nurse,
Brought up the child
without a purse,
But now the Baby's growing up,
Can walk alone —
a healthy pup.

GETTING QUITE A BOY

So, Branch, cast off both
milk and doll,
They're not required after all,
And take full charge of
things yourself,
Including new acquired pelf!

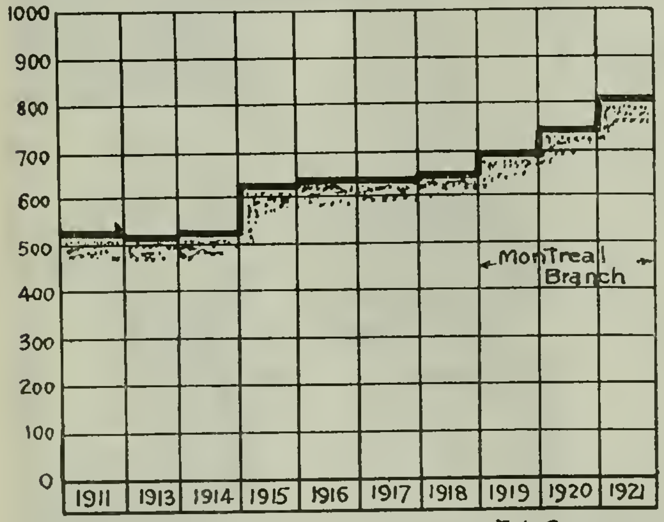
Montreal Branch Cartoons

Montreal Branch

J. L. Busfield, A.M.E.I.C., Secretary-Treasurer.

On April 21st, G. E. Newill, M.E.I.C., read a very complete paper entitled "A Brief Description of some Turbo Machines made in Canada". In introducing the speaker, Mr. Farmer, the Chairman of the meeting drew attention to the development of new lines of manufacture undertaken by industrial companies in order to utilize the machinery installed during the period of the war. Mr. Newill dealt in particular with the manufacture of turbo alternators by the Dominion Bridge Company and explained the difficulties encountered in undertaking the manufacture of entirely new types of machines under conditions very different from anything handled before.

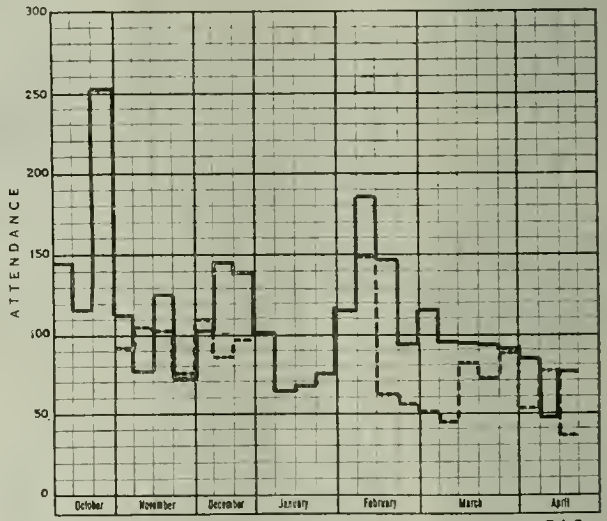
On April 28th, E. T. Spidy presented a paper on "Production Engineering" which will be published in a future issue of *The Journal.* J. H. Hunter, A.M.E.I.C., presided.



E I C
MONTREAL BRANCH.
MEMBERSHIP

The Annual Meeting of the Branch was held on Thursday evening, May 5th, and was well attended. At the opening of the meeting, in the absence of Chairman Surveyer, Past Chairman Walter J. Francis presided. After the reading of the minutes of the previous business meeting, the Annual Report of the Executive Committee was read by Mr. Thornton. This report, after referring to the excellent work done by the Papers and Meetings Committee gave a complete list of the meetings, subjects, authors and attendance for each of the 27 regular meetings of the Branch during the past season. In regard to the attendance at meetings it was pointed out that although the actual numbers generally attending were steadily increasing, there was still room for improvement as there were over 300 members of the Branch who had not attended a single meeting during the past season. The membership of the Branch was given as a total of 819, made up of 3 Honorary Members, 156 Members, 321 Associate Members, 64 Junior, 247 Students, 10 Associates, and 18 Affiliates. Following the above report, the Secretary-Treasurer exhibited some lantern slides showing the growth in membership, attendance at meetings and so forth. The report of Messrs Kemp, Lalonde and Massue, Scrutineers, was then read by Mr. Lalonde, as a result the following elections were effected:—J. H. Hunter, A.M.E.I.C., Chairman, J. A. Duchastel de Montrouge, M.E.I.C., Vice-Chairman, J. L. Busfield, A.M.E.I.C., Secretary-Treasurer, A. E. Dubuc, M.E.I.C., Chas. M. McKergow, A.M.E.I.C. and S. F. Rutherford, A.M.E.I.C., as Committeemen. In addition the proposed alterations to the Branch By-Laws were carried by a large majority and it was also determined that the next election should take place in December 1921.

Mr. Francis then introduced the Chairman-Elect, Mr. Hunter, who thereupon took the chair and thanked the members for the honour accorded to him. He then introduced each of the other elected officers who replied each in their own well known style. Votes of thanks were then passed to the Papers and Meetings Committee, to the Reception Committee, to the Executive Committee and to the Scrutineers.



E I C.
MONTREAL BRANCH
ATTENDANCE AT MEETINGS

A short address was then delivered by A. Rives Hall, K.C., on the work of the Charter Commission with particular reference to the Referendum to be held on May 16th.

After a brief intermission the real business of the evening was commenced. This consisted of the exhibition on the screen of a number of cartoons drawn by A. G. Racey, the well-known cartoonist of the Montreal Star, and characteristically depicting a number of officers of *The Institute* and members of the Branch. The accompanying verses were rather too faint to be read on the screen and were repeated by Fred Brown in his inimitable style. They were received with great enthusiasm and it was very relieving to hear the hall ring with laughter after 27 more or less serious meetings. R. A. Ross also enlivened the proceedings by dilating on his noble brow as shown in the cartoon. (The cartoons are reproduced elsewhere in this issue of *The Journal.*) The audience was so enthused after this exhibition that they burst into song led by Poet and Choirmaster Brown with a delightful rendition (if this is the correct expression) of "Allouette".

As a final tonic General Secretary Keith mounted the platform and gave a very interesting talk on his visit to the West and on the splendid progress being made by the Western Branches and by Western engineers.

*

J. H. Hunter, A.M.E.I.C., has been a very active worker in the Branch since its inception and held the office of Vice-Chairman during the year 1920-21. He has been chief engineer of the Canada Starch Company for a number of years and has been intimately connected with many large industrial developments.

*

J. Duchastel de Montrouge, M.E.I.C., Vice-Chairman of the Montreal Branch, is well known as the city engineer and manager of Outremont; also as the newly elected President of the Automobile Club of Canada. He is a graduate of the Ecole Polytechnique and has been connected with the City of Outremont for about fifteen years.

St. John Branch

Harry F. Bennett, A.M.E.I.C., Secretary-Treasurer.

The members of the St. John Branch were the guests of the retiring Chairman, G. G. Murdoch, M.E.I.C., at dinner at Bond's Restaurant on the occasion of the Annual Meeting on May 6th.

After the dinner and the usual toasts, the business of the meeting was taken up. The Secretary read the reports of the Executive Committee, Publicity, Membership and Advertising Committees, and the Financial Statement. It was shown that the Executive had held seven meetings during the year and the Branch, nine meetings, including three special dinner meetings. Papers of interest had been read and considerable business transacted. The membership had increased to 70 and the finances showed a net increase for the year of $57.34.

The City Planning Committee urged the extension of the present Town Planning Legislation to include the entire area of the City of St. John.

The Civic Centre Committee, which has been assisting the municipal authorities in obtaining information in order to find the best means of housing the various public offices in one group, reported considerable progress. Legislation has been enacted to allow money to be spent by the municipality of St. John for competitive designs and it is hoped that a start will be made on the Law Courts section as soon as building costs reach a low level.

The Concrete in Sea Water Committee reported along the lines of a paper on that subject read at the April meeting and summarized in the May *Journal*. The Employment, Salaries and Entertainment Committees reported their activities. The West Side School Site Committee reported having attained their object of stopping the agitation to build a school on a public square.

The election of officers resulted as follows:—

Chairman: Frank P. Vaughan, M.E.I.C.
Secretary-Treasurer: Harry F. Bennett, A.M.E.I.C.
Executive Committee:
(Two years): A. G. Tapley, A.M.E.I.C.,
A. R. Dufresne, M.E.I.C.;
(One year): G. N. Hatfield, A.M.E.I.C.

Amendments to the By-Laws, affecting the Affiliates and giving Junior members the right to vote in Branch affairs and to hold office, except that of Chairman, were passed.

At the conclusion of the business the new Chairman took the chair and the retiring Chairman thanked the members for their interest during the year and hoped the usefulness of the Branch would extend and the coming year be crowned with success. A hearty toast was drunk to Mr. Murdoch as an expression of the appreciation of the members for his hospitality.

In reply to the toast to the visitors, W. G. Pierce of the N. B. Telephone Company spoke of his recent arrival in the city and the delightful manner in which he had been received. He was sure he had not made a mistake in coming to such a friendly place.

J. T. Johnston, M.E.I.C., of the Ottawa Branch, expressed his pleasure at being present and on return to his Branch would tell them of the progress which St. John was making in Branch affairs.

K. H. Smith, M.E.I.C., of the Halifax Branch, was struck with the manner in which the business was transacted, he hoped the members would adopted the same methods in all their affairs. Mr. Smith advised regular meetings of the engineers, not only to hear papers on technical matters but for a social time when matters of interest could be discussed.

The question of a Maritime Professional meeting was taken up and it was felt that it was not wise to hold such meetings each year.

*

The offices of the Dominion Public Works Department in New Brunswick have been amalgamated with the District Office in St. John under Geoffrey Stead, M.E.I.C., district engineer.

Visit to Canada Lock Joint Pipe Company Plant

That the members of the St. John Branch are interested in the works being carried on in the vicinity of St. John was evidenced by the large number who availed themselves of the opportunity to visit the works of the Canada Lock Joint Pipe Co., Ltd. on Saturday, May 21st.

Through the kindness of W. G. Chace, M.E.I.C., about 50 members and guests went to Manawagonish Road and sat down to Luncheon in the Camp Cookhouse, where the quality and variety of food were all that could be desired. The methods of making the Lock Joint Reinforced Concrete Pipe were explained and at the conclusion of the lunch the works were invaded by the guests and the details watched with interest. Special attention seemed to be paid to the making of the lead gaskets, where wicking is drawn into the lead pipe and the pipe flattened and joined. Another point of interest was the addition of a "Clay Cream" to the concrete mixture to assist in holding the moisture in the mix. It is claimed that after considerable experiment, the pipe made containing this clay mixture shows a smoother finish and will be more water tight than that made with the beach gravel and sand only.

The pipe sections are transported on a three ton truck to the site and lowered into the trench by a traveling crane which spans the cut. The excavating is done with a Keystone Digger.

The visitors spent considerable time on the work and were very much impressed by the methods in use and the results obtained. The Branch is indebted to Mr. Chace and Mr. Bruce for their hospitality and their untiring efforts to make the visit a real benefit to everyone.

Moncton Branch

M. J. Murphy, A.M.E.I.C., Secretary-Treasurer.

The Annual Meeting of the Branch was held on May 5th, in the City Hall. As the Chairman, Mr. Duff, was absent, J. D. McBeath, M.E.I.C., presided.

Annual Report

At a meeting of Professional Engineers held June 11th, 1920, it was decided to organize a Branch of *The Engineering Institute* in Moncton and a Committee was appointed to take the necessary steps.

The Formation meeting was held on October 11th. Fraser S. Keith, General Secretary of *The Institute* was present and gave a very interesting address on the organization and objects of *The Institute.* At this meeting officers were elected and By-Laws drafted which were later submitted and approved by the Council.

The Executive Committee met eight times and transacted a considerable amount of business.

There were ten meetings of the Branch, four in 1920 and six in 1921.

Addresses were given, papers read and important business transacted at the meetings as shown below.

November 4th, 1920. A business meeting was held.

December 2nd, 1920. F. H. Williams, A.M.E.I.C., read a paper on the "History and Survey of Electric Welding Methods", concluding with research work by the writer, illustrated by lantern slides.

January 6th, 1920. At a Supper Meeting, Brig.-General Mitchell, C.B., C.M.G., D.S.O., M.E.I.C., delivered an address on "Engineering in Canada."

January 26th, 1921. John Murphy, M.E.I.C., electrical engineer, Dept. of Railways and Canals, Ottawa, delivered an address on "Ice Formation and Prevention", illustrated by motion pictures. This meeting was open to the public.

February 10th, 1921. Frank Williams, A.M.E.I.C., of the Mechanical Department, Canadian National Railways, read a paper on "Some Features of the Design of Locomotives introduced for the purpose of modifying their effect on the track".

February 21st, 1921. At a Supper Meeting, I. C. Rand delivered an interesting address on "The Relation of Law to the Engineering Profession".

March 3rd, 1921. Regular Meeting for the nomination of officers for the ensuing year.

March 22nd, 1921. At a Supper Meeting addresses were delivered by J. D. McBeath, M.E.I.C., ass't. city engineer on "Street Clearing and its problems" and by R. G. Gage, signal and electrical engineer, C. N. R., on "Railway Signalling and its problems".

April 7th, 1921. W. G. Chace, M.E.I.C., vice-president of *The Engineering Institute of Canada* and president of the Canada Lock Joint Pipe Co., Limited, delivered an address on "The Manufacture and application of reinforced concrete pipe to Municipal Services" illustrated with moving pictures. This meeting was open to the Public.

At the time of the formation of Moncton Branch, the membership was twenty, which has since increased to forty-four an increase of 120 per cent, our membership is as follows:—

Members	10
Associate Members	25
Juniors	6
Students	1
Affiliates	2
	44
Applications pending	20

Eight members of our Branch have been transferred to Toronto, seven of their names are still on the list of members of Moncton Branch at headquarters of *The Institute*, but have not been included in the list of 44 as shown in this report. The departure of these members for Toronto will be a great loss to the Branch as some of our most active workers are amongst those transferred, notably our Chairman, W. A. Duff, M.E.I.C., who has helped in no small way to make Moncton Branch the success it is and James Whitelaw, M.E.I.C., who has also been an enthusiastic worker and the success of our Supper Meetings reflect credit on his activities.

The sincere thanks of the members of Moncton Branch are due Major Wm. McKee (our musical director) and the various gentlemen who so kindly provided entertainment at our Supper Meetings.

As much publicity as possible was given the Branch through *The Journal* and the local press and this no doubt tends to stimulate public interest in the engineer and his work.

The Financial Statement which will be submitted by the Secretary shows a surplus of $109.66.

Address by W. A. Duff, M.E.I.C., Chairman

Gentlemen:—

This is the first Annual Meeting of the Moncton Branch since its organization on October 11th, 1920. At this meeting Fraser S. Keith, Secretary of *The Institute*, gave a very interesting address on the Organization and the objects of *The Institute*, after which the Officers for the first year were elected and I was chosen as your Chairman.

This Branch, I think, has had a very successful year due to the interest taken by the members, and the efficient way the Officers have taken hold and carried on their work.

The Branch started with a membership of 20 and has increased to 50 at the present time, and there are now 20 applications for membership pending. 7 of the above 50 members are on the engineering staff of the Canadian National Railways and have been transferred to Toronto, and, therefore, the present number of members is 43. During the year there have been several meetings, all of which were successful.

At the start of our Branch the principle of getting outside speakers to address the members at least once a month was adopted and several prominent men have given interesting papers.

Slowly but surely, the engineer is becoming more and more prominently associated with all kinds of business and especially where technical knowledge is required the engineer is now looked on as indispensible to successful management. Having Branches of *The Institute* located at different centres is a comparatively new idea, and, I think, has proved a success, but it is most important for the profession that the Branches are kept enthusiastic and not allowed to die out. It is through the members of *The Institute* that I look to see before long the standing of engineers generally brought up to that standard to which the profession belongs. This, I think, can easily be done through the branches of the society in co-operation with *The Institute*, and the more enthusiastic and prosperous a Branch is the greater good it will do, and for this reason I hope the Moncton Branch will become one of the leading Branches of *The Institute*.

I wish to thank the members of the Committees and sub-committees for their very valuable assistance during the past year, and I particularly wish to thank our Secretary, Mr. Murphy, who has been unfailing in looking after the Interests of the branch, and our Vice-chairman, Mr. McBeath, who has on so many occasions acted as Chairman in my unavoidable absence, and to these Committees and Gentlemen is largely due the success of the branch.

I congratulate the Branch on its choice of Mr. McBeath as Chairman for the coming year, and I also congratulate him on being elected to this position. The Branch under his guidance during the coming year I am sure will be most successful.

I regret on account of my transfer to Toronto that I shall be unable to be present at this Annual Meeting, and I also regret on account of my transfer that I have to sever my membership with the Branch, which did me the honour of electing me the first Chairman.

In closing I might say that I shall always be interested in the Moncton Branch, and hope it will always be one of the most successful of *The Institute*.

Banquet to Members Moving to Toronto

On April 21st, the staff of the C. N. R. Engineering Department, the local officials of the Canadian National Railways, and a few other friends tendered a banquet in the Brunswick hotel to Messrs. W. A. Duff, J. A. Ellis, G. R. Doull, J. Leo Keohan, A. H. Jones, R. O. Stewart, James Whitelaw, R. Bostwick and L. McKeage in honour of their recent promotion from the C. N. R. local offices to Toronto to which place they will shortly be transferred.

J. S. O'Dwyer was chairman of the gathering.

Following the repast a very pleasing programme was carried out, following which the toasts to "The King" and "Our Guests" was proposed and several addresses made by the various members of the assemblage.

The toast to "Our guests" was proposed by F. P. Fripp. In proposing the toast Mr. Fripp made particular mention of the regard which the assemblage held for the guests of the evening and the regret at their departure in the immediate future for Toronto. He reminded them that the guests at the banquet had convened to express to them an appreciation of their worth in social life, sports, and business calling. He concluded with a wish that they be granted much success in their future work.

Mr. Duff, in response stated that it was with keen regret that the guests of the evening were about to sever the friendly and very close relations of the past. They too had enjoyed the warmth of appreciation expressed toward them and he felt unable to convey to the assemblage the appreciation and the honour being tendered to them in their removal to another sphere of activities. They would however carry away with them nothing but cherished memories of their many friends in Moncton.

Short addresses were delivered by A. F. Stewart, chief C. N. R. engineer; General Superindendent, J. G. O'Donnell; Divisional engineer, E. G. Evans, Assistant City Engineer, J. D. McBeath, and others.

Mr. McBeath on behalf of *The Engineering Institute* of Moncton expressed deep regret of the Moncton branch at the departure of their guests of the evening. He felt the Moncton branch owed a lot to Mr. Duff who had officiated as its most efficient president. On behalf of the society he wished the guests of the evening good health, wealth and happiness in their new homes. He felt their exit was a distinct loss to the city which could ill afford to lose citizens of the calibre of the guests of the evening.

There were also short addresses from C. N. R. comptroller and treasurer S. L. Shannon and from W. U. Appleton, supt. of rolling stock, C. N. R.

The musical programme was of a high order.

Report of Scrutineers

The Scrutineers, Messrs. E. B. Martin, H. L. Currie, and V. C. Blacket, announced the following officers elected for the ensuing year:—

J. D. McBeath, M.E.I.C., ass't. city engineer, Chairman;
S. B. Wass, A.M.E.I.C., construction engineer, C.N.R., Vice-Chairman;
M. J. Murphy, A.M.E.I.C., assistant engineer, C.N.R., Secretary-Treasurer.

Executive Committee

A. F. Stewart, chief engineer, C.N.R.,
F. B. Fripp, A.M.E.I.C., harbour engineer, C.N.R.,
F. O. Condon, A.M.E.I.C., district engineer, C.N.R.,
R. McManus, A.M.E.I.C., M.L.A. railway contractor,
R. G. Gage, M.E.I.C., signal and electrical engineer, C.N.R.,
H. J. Crudge, A.M.E.I.C., ass't. engineer of buildings, C.N.R.

Halifax Branch

O. S. Cox, A.M.E.I.C., Secretary-Treasurer

The Annual Meeting of the Branch was held in the Green Lantern, Tuesday, May 17th, 1921 at 6.30 p.m., with an attendance of 27, C. E. W. Dodwell, M.E.I.C., presiding.

The Minutes of the Annual Meeting, May 13th, 1920, were read and approved, also the minutes of the meetings held March 24th, April 28th, and May 5th.

W. P. Morrison, M.E.I.C. and C. M. Crooks, A.M.E.I.C., were appointed as scrutineers.

The retiring Chairman then gave his address as follows:—

Address by C. E. W. Dodwell, M.E.I.C., Chairman

When a year ago you honoured me by electing me to this Chair I said that I thought the interests of the Branch would be better served by a younger and more active man as its titular head, so that now, at the end of my year of office, if you find that the Branch is in a flourishing state it may be said that this is not because of, but rather in spite of, my inertia and lack of youthful "pep" and vigour, and due rather to the whole-hearted and cordial support of a most efficient Executive Committee and especially to the zeal and energy of our indefatigable Secretary. To this critism I may retort that if the Branch is not at the present time in a sound and healthy state, which, however, I do not admit, it is partly at least the fault of the membership for not having taken me at my word a year ago.

The facts, figures and financial and numerical status of the Branch will be set before you in the report of the Secretary-Treasurer, which follows these more or less discursive remarks, so I will pass on.

It is usual and fitting that the retiring Chairman's address should give some sort of review of the engineering activities of the Province in which the Branch has been interested collectively as a body or individually by its units.

By far the most important of these are the development of hydro-electric power, and the construction of public highways, in both of which undertakings notable progress has been made, and much money expended.

The Nova Scotia Power Commission, consisting of three prominent men, with the Honourable E. H. Armstrong, Commissioner of Works and Mines, as Chairman, and K. H. Smith, M.E.I.C., one of our best and most active Members, as chief engineer, was established by Order in Council in August, 1919, under the authority of the Power Commission Act, which was passed in May, 1919.

For the following condensed and most interesting resumé of the year's operations of the Commission I am indebted to Mr. Smith. I give it in his own words, because the whole project is one of the greatest possible importance to the prosperity of the Province, and I can not still further condense or epitomize Mr. Smith's summary without spoiling it. Every word of it is interesting and certainly worth inclusion in my address:—

Nova Scotia Power Situation

"During the past year considerable progress has been made towards ultimately supplying all the more densely populated sections of the Province with an adequate supply of electrical energy from hydro-electric and other sources. It is thought that with the natural resources of water power, coal and oil at its disposal, the Province of Nova Scotia may reasonably expect ultimately to be in a position in so far as a power supply goes, comparable in many respects to other parts of the Dominion of Canada, such for example, as Quebec, Ontario, Manitoba and British Columbia. The St. Margaret's Bay development with an initial turbine capacity of 10,700 h.p. and an ultimate capacity of about 15,000 h.p. was begun early in 1920 and is now nearing completion. This development is of the most modern type and of the most permanent construction. The present installation consists of four direct connected hydro-electric units of the vertical shafts type, two with a capacity of 2,900 k.v.a. and two with a capacity of 1600 k.v.a. Provision is being made for two additional units. All the dams and buildings are of permanent concrete construction while the transmission line cables will be supported on structural steel towers.

The whole development is somewhat interesting from an engineering standpoint involving the diversion of one river to another, the utilization of the same water twice over in two different power houses and the combination in one building of hydro-electric units operating under different heads.

The Nova Scotia Power Commission took over some time ago the hydro-electric plant and transmission system of the Lunenburg Gas Company and is extending it to supply Riverport as well as Lunenburg. This system is now in operation by the Commission, and the power plant itself will be entirely remodelled and enlarged during the present summer by the installation of modern vertical shaft machinery of much larger capacity and much higher efficiency than that now in operation. It is expected that this plant when completed will supply the needs of the Mahone Lunenburg-Riverport-Bridgewater district for some little time.

A very complete investigation and study of a proposed hydro-electric development on East River, Sheet Harbour for the purpose of supplying the industrial centres of Pictou County has been made. This development will ultimately have a capacity of from 25,000 to 30,000 h.p. being considerably larger than the St. Margeret's Bay development. It is thought that a beginning may be made on this development probably with a comparatively small initial development at an early date.

It is also expected that at an early date the Commission will have a hydro-electric plant in operation in the lower part of the Annapolis Valley, whether by taking over an existing small hydro-electric plant, or by building an entirely new development.

It is expected that an investigation of supplying the Cumberland Co. mining and industrial district with electrical energy from a central steam plant near the coal mines will shortly be undertaken. Such a steam plant would ultimately link up with the various water powers of the Province now being developed or under consideration.

A brief report recently issued by the Nova Scotia Power Commission, which may be obtained at the Power Commission office, or form the King's Printer, contains more detailed information concerning the activities of the Commission."

So much for Mr. Smith's report for which I offer him my personal thanks and those of the whole Branch.

Another project of immense importance, but chiefly to the City of Halifax, is to be found in the South end of the City.

If the progress towards completion of this great and costly work, the piers, freight sheds, permanent station and all the rest of it has not been commensurate with the needs of the city and the wishes of our citizens, we must possess our souls in patience, realizing the gravity of the financial outlook and the enormous and unprecedented debt which we have incurred by our glorious participation in the recent colossal war, and making all necessary and adequate draft on our faith that in the fulness of time the Federal Government may find it possible and expedient to carry this important work to a successful issue.

In spite, however, of its unfinished state it is already fulfiling a useful purpose, for I am credibly informed that several large steamers, taking advantage of calm weather and immunity from easterly winds, have berthed alongside one or other of the two completed piers and

I know as a matter of fact that numerous trains depart from and arrive at the new station every day.

It is a matter of but secondary concern to the Branch generally, though of direct personal interest to a dozen of its Members, that the Public Works Department of the Federal Government, in the interest of efficiency and economy, has inaugurated a new regime by reducing the number of Districts into which the whole Dominion was divided,—for purposes of Departmental administration,— from thirty-one to less than half that number, New Brunswick being reduced from four Districts to one District and Nova Scotia from five Districts to one, with Halifax as headquarters of the unified new staff for the conduct of works in the construction of piers, wharves, breakwaters, dredging operations and other permanent features of harbour construction on the 2,500 miles of coast line that girdle our Provincial coast with a line of remarkable crookedness and on which are to be found over 500 separate harbour works of various kinds. The net result of this re-arrangement, so far as the Branch is concerned, is to bring to the City some seven or eight engineers who will no doubt seek early enrollment as regular members of the Halifax Branch.

Now a few remarks in regard to that supremely important matter of the public highways of our fair Province.

Early in 1919 the Provincial Government, in response to the peremptory demand of public opinion for better roads, secured material financial aid from the Federal Government, borrowed large sums of money and added to its Executive Machinery a special Department with a newly selected and appointed Minister at its head, and for purposes of direct administrative control a Board or Commission of four prominent men from different parts of the Province.

A large staff of engineers was organized, with J. W. Roland, M.E.I.C., as chief. During the last year an aggregate sum of about $4,000,000 was expended in four main classifications.

(1). Construction of roads under aid from the Federal Government, under which the sum of about $900,000 was expended on about 70 miles of macadamized road in the various parts of the Province.

(2). Construction of roads under Provincial Loans.

Under this category the outlay was approximately $1,300,000 on a total length of 1,320 miles.

(3). Maintenance of roads and bridges.

In this work the outlay was $1,000,000, the work done being distributed over practically the whole Province.

(4). Construction of larger bridges and culverts.

In this class two bridges of considerable size have been under way, that over Allen's Creek, at Annapolis, and that across the Annapolis River, to connect the town of Annapolis with Granville Ferry.

The latter will be a steel superstructure of an aggregate length of 1,360 feet, now under contract and to be erected on piers built some years ago by the Public Works Department of the Federal Government. The piers are of rather unusual construction, being creosoted, square timber cribs, filled with stone and surmounted by 27 feet in height of concrete. The cost of these two bridges, not including the substructure of the latter work, will somewhat exceed $400.000.

For these facts and figures I am indebted to the kindness of W. A. Hendry, M.E.I.C., chief engineer of the Provincial Highways Board.

Active preparation for this season's work have been in progress for some little time and it is confidently anticipated that between now and next Christmas many miles of excellent road will be added to the Provincial system.

In connection with the question of Roads I deem it my duty on this occasion to say something in regard to a matter that for the past few months has given to the Branch in general, and to its Executive Committee in particular, no little anxiety and concern.

In as few words as possible I will recall to your recollection the leading facts and circumstances.

Last autumn, in connection with the administration of, and payments on account of large contracts, troubles arose, which I need not particularize, but that they were of a serious nature, or were so regarded by the Commission, is shown by the fact that Mr. Roland and a number of his subordinate engineers were peremptorily dismissed in December, 1920, for causes unknown to the general public, or to the E.I.C.

The matter was seriously discussed at a Meeting of the Halifax Branch, E.I.C., on Wednesday evening December 15th, 1920, and a Resolution was passed calling upon the Highways Board either to change Mr. Roland's dismissal to suspension, pending the result of the prolonged and thorough investigation then being instituted, or to give the same publicity to the reasons, that had been given to the fact, of his dismissal.

A copy of this Resolution was sent to the Highways Board on the 16th of December and acknowledged by the new Chairman on the 18th.

On the 29th of December the Chairman again wrote to our Secretary that the Board had decided to take no action on our Resolution.

On the 7th of January, 1921, the Executive Committee of the Branch, in whose hands the matter had been left by the Branch, again wrote to the Chairman of the Board respectfully requesting to be informed as to the reasons for their summary dismissal of Mr. Roland.

On the 27th of January the Chairman of the Board wrote our Secretary that the Board had nothing more to say regarding the matter, and that, so far as the Board was concerned, it was closed.

This final communication from the Board may not unreasonably be regarded as an uncalled for discourtesy.

The correspondence between the Board and our Secretary was thoroughly debated at several meetings of the Executive of the Branch and it was decided that no further action could be taken until publicity had been given to the final report of the Special Commission appointed to carry out the investigation into the whole subject.

This report has now been before the public since early in April, but in it there can be found no reasons whatever for Mr. Roland's dismissal, though we cannot dispute the right of the Board to dispense with his services. He is not charged with, nor has he been proved guilty of, malfeasance, misfeasance, unprofessional or dishonourable conduct, or of incompetence, neglect of duty or criminality. The true inwardness of his dismissal may be known to himself, or to the Board, or to the Government, but it seems doubtful if it will ever be known by the general public, or the E.I.C., and therefore in so far as the Halifax Branch is concerned the matter is closed.

Before finally dismissing it, however, I might call your attention to the interesting fact that the episode, in several of its features at least, has its analogy or prototype in Holy Writ.

The chief engineer was sacrified as a sin-offering, not, be it remarked, for his own sins—so far at least as the matter has developed—but for those of some person or persons unknown and of whom the identity has not transpired.

The second in executive engineering command without waiting for the issue of the inquiry shook from his feet the dust of the Roads that he had been supervising and departed into the wilderness from whence he came.

Is it not written in the 16th Cap. of Lev., from 7th to 10th verses:—

Lev. XVI. 7.—And he shall take the two goats and present them before the Lord at the door of the Tabernacle of the Congregation.

8.—And Aaron shall cast lots upon the two goats; one lot for the Lord and the other lot for the Scape-goat.

9.—And Aaron shall bring the goat upon which the Lord's lot fell and offer him for a sin-offering.

10.—But the goat on which the lot fell to be the Scape-goat shall be presented alive before the Lord to make an atonement with him, and to let him go for a Scape-goat into the wilderness.

Before leaving the subject of Roads I should like to take the opportunity of expressing to this Meeting my surprise and regret that the Good Roads Association, which had an important and largely attended Convention here last week, should have ignored **The Engineering Institute** of Canada and not given the Halifax Branch as a body, by notice or invitation to its officers or representatives, an opportunity of taking part in their Convention. Inasmuch as the construction and maintenance of public highways is an important feature of the professional work and activities of **The Engineering Institute of Canada**, and of many of its members, I venture to think that it would have been to the mutual interest and advantage of the Good Roads Association and **The Engineering Institute** if the former organization had accorded to the latter the opportunity of participating in the proceedings and discussions of last week's sessions. I am sure, also, that the Halifax Branch of the E.I.C. would have been glad, and perhaps able, to show the Good Roads Association, or some of its officers and representatives, a little hospitality on the occasion of their visit to our little old city by the sea.

I need only add that the Halifax Branch of The Engineering Institute of Canada wishes the Good Roads Association every possible success in their admirable efforts towards the improvement of the public highways of the country.

I regret that I am not in a position to give much definite information or encouragement to the younger engineers throughout the Province and to the engineering students at our different provincial Colleges.

Of these latter there are a total of about 260, of whom 12 graduate this year from the Technical College and about 80 from the other Colleges. Dalhousie, King's, Acadia and St. Francis Xavier are ready to take up their special Engineering courses at the Technical College or some other scientific finishing shop, such as McGill or Toronto.

At first sight these figures seem discouraging, but it most be borne in mind, first, that the numbers of students at these different Colleges who are going in for law, medicine, theology and other professions are probably quite as great as those taking up engineering, and, second, that the field for professional engineers in wider in its branches, specialties and ramifications than other professions.

Further, so far as I am aware, there is no reason to suppose that the tendency to crowd the profession is any greater now than it has been in the past. I am inclined to believe that a full analysis of statistics, were such available, would probably show that it is less, for one reason on account of the unprecedentedly high wages that are now paid to skilled artisans and mechanics in every trade, master plumbers, machinists, boiler makers, carpenters, masons, plasterers, railway locomotive drivers and conductors, nearly all receive higher pay than most salaried engineers of under 40 years of age. On a casual purview this strikes us very forcibly as a grave dislocation of the relationship between brain and brawn, or at least of all our preconceived and orthodox notion of them, but, if we could get down to the footing courses of the whole post-war industrial structure, I believe we should find underlying them the same old immutable laws of supply and demand operating as inevitably and as ruthlessly, though more inscrutably, than the laws of chemical affinity.

To engineering students, and to those young men in the awkward squad, so to speak, or the kindergarten of the profession itself, let me say that more will be expected of you than was asked of your Professional fathers and elders, not because your brains are any better than ours, but because the training of engineers nowadays is better and more thorough than it was a generation back, and, which is more important, because the magnitude and difficulty of the problems to be solved and the tasks to be performed by engineers are greater and more difficult today than they have every been, and as year follows year and as inventions and discoveries follow inventions and discoveries they will doubtless become ever increasingly greater and more difficult.

But remember this, the greater the difficulty the greater the triumph, and in engineering as in other learned scientific callings the foothills are the roughest and steepest, the higher you get the easier the climbing and there is lots of room at the top.

The report of the Secretary-Treasurer for the Branch year 1920-21 was then read as follows:—

Mr. Chairman and members of the Halifax Branch:—

During the Branch year 1920-1921, eight meetings of the Branch have been held as follows:—

May 13th, 1920; Annual Meeting at which the officers for 1920-1921 were elected, Addresses were given by General C. H. Mitchell, M.E.I.C., of Toronto and Dr. F. H. Sexton of Halifax.

November 17th, 1920; a general business meeting devoted particularly to a discussion of the question of classification and remuneration of Engineers. A committee was appointed to study this matter on behalf the Branch.

December 15th, 1920; Col. W. E. Thompson gave a talk on the water supply of Halifax, chiefly from the standpoint of fire insurance, supplemented by F. W. W. Doane, M.E.I.C., from the standpoint of the Engineering department of the city.

January 28th, 1921, John Murphy, M.E.I.C., of Ottawa gave a talk on the formation of ice and its prevention, illustrated by moving pictures and lantern slides.

February 23rd, 1921; J. F. Ryan discussed paints and their uses.

March 24th, 1921; A. C. Brown, A.M.E.I.C., read a paper on reinforced concrete fishery piers as constructed at St. Pierre, Miquelon.

April 28th, 1921; A. J. Barnes discussed some Engineering features of the automatic telephone, supplemented by lantern slides and a demonstration by a miniature exchange.

May 5th, 1921; W. G. Chace, M.E.I.C., of St. John, gave a talk on Reinforced Concrete as applied to water supply.

Present Membership:—

Members	30
Associate Members	49
Juniors	18
Students	12
Branch Affiliates	6
Total	115

Financial Statement—Branch Fiscal Year 1920-21

Receipts:—

Rebates from Head Office	$162.82
Fees from Branch Affiliates	20.00
From Hx.-Department Br. Com	94.50
Bank Interest	3.93
Balance on hand May 11th, 1920	45.37
	$326.62

Disbursed: –

Clerical Help	$ 60 00	
Office Supplies	1 10	
Postage	20 58	
Bank Charges	45	
Telegrams	3 89	
Expenses of Meetings	13 05	
Express	.70	
Gratuities	1 .00	
Advertising	9 .80	
Journal Subs. for Br. Affiliates	6 .00	
L. H. Wheaton, Prof. Services	94 .50	
Printing notices etc	24 .48	
		$235 .55
Balance on hand		$91 .07

Respecfully submitted,

F. R. Faulkner,

Secretary-Treasurer.

Audited and found correct

H. W. Doane, } Auditors.
J. B. Hayes, }

The adoption of this report was moved by I. P. Macnab, M.E.I.C., and seconded by H. W. Mahon, A.M.E.I.C., and carried.

The report of the Committee on Classification and Remuneration of Engineers was presented by the convener.

This report evoked considerable discussion. On motion of K. H. Smith, M.E.I.C. and W. P. Morrison, M.E.I.C., the report of the Committee was adopted and the Committee continued in office as a reference body for the Halifax Branch.

Arising out of that part of the Chairman's address on the Good Roads Convention, the Executive Committee were instructed to send a letter to the Executive of the Good Roads Association of the Province, voicing the approval of the Branch in the efforts of this Association to secure good highways, and offering the co-operation of the Branch.

The following resolution was moved by F. R. Faulkner, M.E.I.C., seconded by I. P. Macnab, M.E.I.C., and carried unanimously.

Whereas; J. W. Roland, M.E.I.C., a prominent and respected member of the Halifax Branch, Engineering Institute of Canada, was summarily relieved of his duties as Chief Engineer of the Highways Board of the Province of Nova Scotia in December 1920, and

Whereas; the said Highways Board was, at the time of the summary dismissal of Mr. Roland, under investigation by the Royal Commission, and were not, in the opinion of the said Branch, justified in their action without publicly giving their reasons for action and

Whereas; the Halifax Branch of The Engineering Institute of Canada were unable to obtain from the Highways Board, after repeated courteous requests, any reason, adequate or otherwise for the summary dismissal of Mr. Roland and

Whereas; the Royal Commission having specifically found: "In respect to the Highways Board's Chief Engineer, we think it right to say that his honesty and truthfulness have not been questioned. These are great assets. Neither does there appear to be any question as to his capacity as an engineer", therefore be it

Resolved; that in the opinion of the members of the Halifax Branch, Engineering Institute of Canada, the Highways Board of the Province of Nova Scotia, as at that time constituted, showed a lack of courtesy to the Engineering Institute of Canada and Professional Engineers in general and to the Halifax Branch in particular, which is to be deplored in a body in their public and responsible position, and be it further

Resolved; that the Halifax Branch of the Engineering Institute of Canada, hereby express their deepest sympathy to Mr. Roland in the trying ordeal through which he has passed and affirm their belief in his personal and professional integrity and in his capability as a professional engineer; also that a copy of this resolution be spread on the minutes of this meeting and be published in "The Journal".

In addition to the foregoing, it is felt desirable to give publicity to the extract below from the speech of the Hon. H. H. Wickwire, Minister of Highways for the Province of Nova Scotia, given before the Nova Scotia Legislature on Wednesday May 18th, 1921:—

Mr. Wickwire had no apology to make for Mr. Roland. He believed him to be good, conscientious, honest and competent, "and if it were up to me tomorrow to seek an engineer, I would hesitate a long time before I would pass him," declared Mr. Wickwire with very evident emotion, amid the loud applause of both house and galleries.

The Secretary pointed out the desirability of an early start on a programme for next year and urged that every member constitute himself a committee to increase attendance at the meetings and to enlarge the membership of the Branch. On motion the following were appointed a Committee to arrange for papers:—

A. C. Brown, Chairman
J. B. Hayes
C. St. J. Wilson
H. W. L. Doane

The report of the scrutineers showed the results of the balloting for officers for the ensuing year:—

Chairman.	C. E. W. Dodwell, M.E.I.C.
Secy.-Treas.	O. S. Cox, A.M.E.I.C.
Exec. Comm.	H. W. L. Doane, A.M.E.I.C.
	F. R. Faulkner, M.E.I.C.
	J. B. Hayes, A.M.E.I.C.

On motion a cordial vote of thanks was tendered the retiring Secretary-Treasurer by the Chairman and the meeting closed with the National Anthem.

Meeting of Good Roads Convention at Halifax, N.S.

The annual meeting of the Good Roads Association of Canada was held in Halifax, N.S., May 10th, 11th and 12th. Every Province in the Dominion was ably represented and there were a number of delegates from the United States. Members began arriving in the city as early as the Saturday preceding convention week and every train entering Halifax after that brought its quota. Members of Provincial Cabinets and of

Provincial Legislatures; members of Highway Boards and Commissions, Dominion, Provincial, City and Municipal highway engineers, including many prominent members of *The Institute*, combined with officials and members of Provincial and National Good Roads Associations to make a gathering peculiarly National in its representation and of vital interest to every citizen in Canada.

The Headquarters of the Convention was the Nova Scotia Technical College where registration began at 9.00 a.m., Tuesday. May 10th. At 10.00 a.m. the Convention was formally opened by Dr. E.M. Desaulniers, the President, and the delegates were welcomed to Nova Scotia by his Honour, Lieutenant Governor Grant, by the Hon. E. H. Armstrong, acting Premier of the Province, and by Mayor Parker of Halifax.

In all, six sessions were held and the official programme below gives an excellent idea of the scope and nature of the subjects discussed:—

Address: "Federal Aid—Progress to date", Hon. P. J. Venoit, Minister of Highways, Province of New Brunswick.

Paper: "Gravel Roads", B. M. Hill, M.E.I.C., provincial highway engineer, New Brunswick.

Paper: "How to Improve and Maintain Earth, Clay and Sand Roads", Paul D. Sargent, chief highway engineer, State of Maine.

Paper: "Bituminous Treatment ol Gravel and Sand Roads", Col. W. D. Sohier, ex chairman, Massachusetts Highway Commission.

Address: 'The Road Situation in Brittan's oldest Colony", R. Gibbs, Secretary, Road Commission, Newfoundland.

Address: "Some Phases of Federal Aid", A. W. Campbell, M.E.I.C., commissioner of roads, Dominion of Canada.

Paper: "Economical Methods of rebuilding Gravel and Macadam Roads", E. A. James, M.E.I.C., chief engineer, York Highway Commission, Toronto.

Paper: "Right of Way and Road Bed Widths," W. A. McLean, M.E.I.C., Deputy Minister of Highways, Ontario.

Paper: "Financing, Bonding and Revenue for Highways Construction", Wm. Findlay, business manager, "The Globe", Toronto.

Paper: "Standardizing the Qualifications of Highway Engineers throughout Canada and maintaining high Standards of Efficiency", A. E. Foreman, M.E.I.C., consulting engineer, Portland Cement Association, Victoria, B.C.

Address: "Progress in Road Building on the Island Province of Prince Edward Island", Hon. C. W. Crosby, Minister of Public Works, Prince Edward Island.

Address: "Colonization Roads", W. F. Fullerton, Supt. of Colonization Roads, Province of Ontario.

Paper: "How to Preserve a Macadam Road", A. P. Sandles, Secretary, National Crushed Stone Association, Columbus, Ohio.

Paper: "Care and Handling of Modern Road Machinery", Geo. Hogarth, M.E.I.C., chief engineer, Highways Department, Province of Ontario.

Address: "Good Roads developments in the West", Hon. S. J. Latta, Minister of Highways, Saskatchewan.

Paper: "Asphaltic Concrete Pavements", Charles A. Mullen, A.M.E.I.C., consulting paving engineer, Director, Paving Department, Milton Hersey Co., Montreal.

Paper: "Highway Bridges and Culverts". A. McGillivery, A.M.E.I.C., chairman Good Road Board, Province of Manitoba.

Paper: "Cement Concrete Roads", H. S. Van Scoyoc, A.M.E.I.C., publicity manager, Canada Cement Co., Montreal.

Address: "The Road Contractor", Lucius Allen, M.E.I.C., consulting engineer, Belleville, Ont.

Paper: "Refined Tar in Construction and Maintenance", Philip P. Sharples, Manager, Tarvia Dept. The Barret Co., New York City.

Paper: "Maintenance", J. A. Duchastel, M.E.I.C., Manager, City of Outremont, Quebec.

In addition to the regular meetings of the Convention, the delegates were entertained by various clubs, societies and organizations. The Lieutenant Governor held a reception in their honour; luncheons, theater parties and suppers combined to fill up their time. On Friday May 13th, the delegates entrained for a trip through the "Land of Evangeline" when they were the guests of the Boards of Trade of Wolfville and Kentville at luncheon followed by motor trips through the surrounding country. As one of the delegates expressed it: "They call you 'Bluenoses', but your blood is red, your hearts are warm and your hospitality knows no bounds."

Engineering Alumni Association of the University of Toronto

The results of the election of the officers of the Engineering Alumni Association of the University of Toronto have recently been announced as follows:

President, Walter J. Francis, C.E., M.E.I.C., (acclamation);
First Vice-President, W. A. Bucke, B.A.Sc., A.M.E.I.C.;
Second Vice-President, J. B. Challies, C.E., M.E.I.C.;
Third Vice-President, R. J. Marshall, B.A.Sc.;
Secretary, C. E. McDonald, B.A.Sc., A.M.E.I.C., (acclamation);
Treasurer, W. E. Douglas, B.A., A.M,E.I.C.;
Representatives, H. G. Acres, M.E., M.E.I.C.; E. R. Gray, C.E., A.M.E.I.C.; F. W. Thorold, B.A.Sc., M.E.I.C.; W. G. Swan, C. E., M.E.I.C.

Preliminary Notice

of Applications for Admission and for Tranfer

19th May 1921

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal eputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in June, 1921.

Fraser S. Keith, Secretary.

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*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option, Railway, Municipal, Hydraulic, Mechanical, Mining or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects, Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits scientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

ARBUCKLE—JAMES STEWART, of Pictou, N.S. Born at Pictou, Nov. 19th, 1892; Educ., B.Sc. (E.E.), McGill Univ., 1920; 1911-12-13 (summers), elect'l wiring of bldgs., Pictou; With N.S. Steel & Coal Co. as follows:—1915 (summer), asst. to pile driver engr., 1916-17 (summers), asst. on constrn. and mtce. of elect'l apparatus, 1917-18, chief electrician of shipyard, mtce. and constrn.; 1919, also summer 1914, contractor for elect'l wiring of bldgs., Pictou, N.S.

References: L. A. Herdt, C. V. Christie, E. G. Burr, E. Brown, A. R. Roberts, D. H. McDougall, A. Stansfield.

BARE—HENRY St JOHN, of Outremont, Que. Born at London, England, Nov 3rd, 1880, Educ., Polytechnic School, London, England; 3 years as pupil with contractor during constrn. of Central London Rly., 6 years drawing office pumping machinery, James Simpson & Sons, London, 1907-09, city dftsman, Phoenix Bridge Co.; 1909-13, dftsman., C.P.R., 1913, res. engr., C.P.R. Angus Shops, 1915 res. engr., C.P.R. Montreal Terminals; 1920 to date, bldg. engr. in charge of constrn., C.P.R. Angus Shops

References: J. M. R. Fairbairn, A. C. Mackenzie, J. E. Beatty, J. W. Orrock, P. B. Motley.

BIRRELL—ALLAN LLOYD, of Toronto, Ont. Born at Toronto, Ont., Jan 28th, 1893. Educ., grad. S.P.S., Univ. of Toronto, 1915. 1915, June-Dec., asst. engr. Civic Transportation Committee, Toronto; 1916-17, asst. office engr. Toronto Harbour Comm., surveys and lands dept.; 1918-19, on active service; 1919 to date office mgr. and engr. in charge of design of mech. equipment of bldgs. for Chapman, Oxley and Bishop.

References: F. B. Goedike, J. F. Willsie, H. A. Goldman, J. M. Oxley, N. D. Wilson, J. Mack.

BROUSSEAU—LUCIEN, of Quebec, Que. Born at Sorel, Que., March 5th, 1887; 1904 (summer) rodman, mtce. of way, C.P.R., Montreal; 1905 (summer), St. Maurice Valley Branch Constrn., C.P.R.; 1906, rodman and dftsman, constrn., topog'r. on location, C.P.R.; 1906-13, mtce. of way dept., C.P.R., Montreal — 1906-10, rodman and dftsman, 1910-12, transitman, 1912-13, asst. engr. or senior transitman, 1913-20, divn. engr., mtce. of way, C.N.R. Levis, Que.; June 1920 to date, district engr., mtce. of way, C.N.R., Quebec.

References: C. B. Brown, J. M. R. Fairbairn, A. F. Stewart, W. A. Duff, F. B. Tapley, F. L. C. Bond, H. T. Hazen, I. E. Vallée, A. A. Bélanger, H. A. Paquette.

BRUCE—HENRY WILLIAM HARVEY, of Allanburg, Ont. Born at Ottawa, Ont., Feb. 27th, 1881. 1898-1903, with Canada Atlantic Ry., as rodman, leveller, transitman, on surveys and constrn.; 1903, res. engr. C.P.R. Bobcaygeon to Burketon Branch; 1904-06, transitman T.C. Ry.; 1908, res. engr. C.P.R. Toronto-Sudbury Branch; 1909, transitman and in charge of party, Hudson's Bay Ry.; 1910, res. engr. Quebec Saguenay Ry.; 1911-13, res. engr. C.N.R. Sudbury Dist.; 1914-18, on active service; 1918, asst. engr. St. Lawrence River Ship Channel; 1919 to date engr in charge Section 5, Welland Ship Canal.

References: A. J. Grant, V. W. Forneret, E. T. Agate, A. N. Molesworth, G. A. Mountain.

CANDLISH—JOHN BOYD, of Niagara Falls, Ont. Born at Glasgow, Scotland, Jan. 29th, 1894; Educ., grammar school private tuition and apprenticeship with sanitary engrs., England. With same firm as elec'n and foreman; 1915-16 mgr., Candlish Elec. Co., Niagara Falls; 1916-18, engr., dept. C.G.E. Co., Peterboro, specializing on transformers and later in charge of transformer dept.; 1918 to date, with Herbert Morris Crane Co., first in engr. dept., and sales mgr., then in charge of mech. and elec. design; carried out special work on induction motors from original design; at the present time chief engr., same Co.

References: M. R. Meldrum, L. L. Gisborne, R. P. Johnson, C. E. Sisson, A. B. Gates, J. M. Morton, J. A. Shaw, W. H. Winterrowd.

COOKE—NORMAN MELVILLE, of Kingston, Ont. Born at Kingston, July 27th, 1890; Educ., Final year student Civil Engr'g., Queen's Univ.; Summer 1920, asst. to County engr., Stormont, Dundas, Glengarry, Cornwall, Ont

References: A. Macphail, W. P. Wilgar, W. L. Malcolm, D. S. Ellis, J. G. Cameron.

DUCLOS—LEWIS MURRAY, of Montreal, Que. Born at Ottawa, Ont., June 22nd, 1890; Educ., Engr'g. cert., Acadia Univ. 1914; 1911-12-13 (summers), with C.P.R. One summer as rodman and inspr. of concrete in bridge constrn.; 1917, transitman, C.P.R.; 1917-19, overseas; 1919 (May-Dec.), in charge of constrn. of wooden block pavement on concrete base; April 1920 to date, senior instr'man., asst. engr's office, Montreal division, G.T.R

References: W. W. Benny, J. P. Menard, W. Walker, H. Luscombe, A. S. Going, K. R. McLennan.

DUSTAN—ERNEST BRUCE, of Windsor, Ont. Born at Pictou, Nova Scotia, Sept. 9th, 1894; Educ., B.A.Sc. University of Toronto, 1920; 1912-13, Maritime Bridge Co., New Glasgow, Bridge shop and drawing office; July 1920 to date, dfts'man Canadian Bridge Co., Walkerville, Ont.

References: G. F. Porter, S. E. McGorman, G. V. Davies, C. R. Young, P. Gillespie.

FITZPATRICK—EDWARD M., of Montreal, Que. Born at Armagh, County Armagh, Ireland, 7th May, 1889; Educ., 3 year course Armagh Technical School (trades and engineering); 1 year Arts, Royal University of Ireland; served pupilage 3 years to R. H. Dorman, 1909-12; 1912-14 Chief Office Asst. to R. H. Dorman, and in complete charge of 80 miles of road; 1914, 5 mos. Engineering Dept., C.P.R. under J. M. R. Fairbairn; Aug. 1914 to May 1915, Montreal Light, Heat & Power Co., Cedar Rapids; 1915-16 with the Can. Ingersoll Rand Co., Inspector on Munitions; 1916-19 with the C.E.F. in France and Belgium; 1919-20 Draughtsman, Maple Leaf Motor Truck Co.; Nov. 1920 to date, Draughtsman with the Montreal Water Board.

References: W. B. McLean, J. M. R. Fairbairn, C. J. DesBaillets, F. E. Field, F. Y. Dorrance, W. Matheson, J. F. Brett

HAGUE—KENNINGTON HENRY SCOTT, of Montreal, Que. Born at Montreal, Que., July 12th, 1892. Educ., B.Sc. (E.E.) McGill Univ. 1914 1911 (summer) with Tate Accumulator Co., Montreal, assembling and testing storage batteries; 1912 (summer) with Marconi Wireless Co., testing and assisting instal'n.; 1913, Can. Westinghouse Co., assembling motor accessories; 1914-15, tech. salesman and asst. to mgr. with Standard Underground Cable Co., Montreal and New York; 1915-19, on active service. At the present time electrical engr. for A. A. Giddings & Co., Montreal.

References: J. M. R. Fairbairn, A. E. Dubuc, P. S. Gregory, J. C. Day, R. D. Sutherland.

HELBRONNER—PIERRE MICHEL, of Montreal, Que. Born at Montreal, Oct. 22nd, 1876; Educ., 4 years pupilage with A. T. Taylor, F.R.I.B.A Archt'l. lectures McGill Univ., 1896-97; 1893-98, student and dftsman., Taylor & Gordon, Architects; 1899 to date (with exception of 1914-19 when overseas), with T. Pringle & Son Ltd., Engrs. and Archts. as follows: 1899-1907, dftsman and supervising archt., 1907-14, member of firm and in responsible charge of design and supervision of various bldgs. etc. and 1919 to date, archt. and engr. in responsible charge of work.

References: A. Pringle, J. S. Costigan, G. M. Wynn, P. A. N. Seurot, A. F. Byers, L. A. Herdt, W. 1. Bishop.

HICKEY—AMBROSE JOSEPH, of East Wabana, Nfld. Born at Harbour Main, Nfld., 31st July, 1899; Educ., I.C.S. in Surveying and Mapping for 6 years with Dominion Iron & Steel Co., Wabana Mines, on Survey Staff; 3 years as Instrument man.

References: J. H. Morley, S. C. Mifflen, J. B. Petrie, J. B. Gilliatt, C. B. Archibald.

HOLDER—GEORGE WILLIAM, of Sault Ste Marie, Ont. Born at Ottawa, Ont., June 6th, 1893. Educ., 1 year app. sc. McGill Univ., 1911-12; taking I.C.S. course in civil eng. 1912-17, asst. engr. D.P.W., Canada; 1917-18, asst. and res. engr. with James O. Heyworth, Sault Ste Marie, Ont.; 1918, p.t. Fraser Brace Co.; 1919 (7 mos.) office G. L. Ramsey, O.L.S.; 1919 to date, surveyor and field engr. and asst. to hydraulic engr., Spanish River Pulp and Paper Co., Sault Ste Marie.

References: G. H. Kohl, W. J. Fuller, B. E. Barnhill, J. B. D'Aeth, W. S. Wilson.

HUGHES—WILLIAM, of Niagara Falls, Ont. Born at Stockport, Cheshire, England, June 26th 1894; Educ., I.C.S. Vocational Training Course, Mech. dfting. Evening classes; 1912-14, rodman and instr'man. with J. W. Tyrrell Co., Hamilton; 1914-19, overseas; 1920 (Feb.-July), dftsman, (July-Oct.) asst. to master mechanic, American Cyanamid Co., Niagara Falls; Since April 1921, field dftsman, H.E.P.C., Niagara Falls.

References: J. W. Tyrrell, S. R. Frost, W. S. Orr, A. C. D. Blanchard, F. W. Clark.

JAMIESON—ROBERT EDWARDS, of Westmount, Que. Born at Ottawa, Ont., Nov. 5th, 1891; Educ., B.Sc. (Civil), McGill Univ., 1914; 1908-10, time and bkpr., constrn. of N.T.C. Ry. with M. G. Henniger, contractor; 1911 (summer), transitman, Quebec & Saguenay Rly., location and constrn.; 1912 (summer), C.P.R. constrn.; 1913 (summer), transitman, mtce. of way, C.P.R.; 1914 (season), transitman, magnetometric and topographic survey, Mines Branch, Dom. Govt.; 1915, demonstrator, Dept. of Civil Engr'g , McGill Univ., and lecturer, Prov. Tech. School, Montreal; 1916 (Jan.-May), asst. engr., design office, Halifax Ocean Terminals; 1916-19, overseas. Lieut., Can. Siege Artillery; Summer 1920, asst. engr., C.P.R., on struct'l design of addition to Chateau Frontenac; At present, lecturer in Mathematics and Civil Engr'g., McGill University.

References: R. DeL. French, W. C. Thomson, H. M. MacKay, G. McL. Pitts, H. M. Lamb, D. W. Jamieson.

JEMMETT—DOUGLAS MILL, of Kingston, Ont. Born at Gananoque, Ont., Aug. 17th, 1890; Educ., M.A. 1911, B.Sc. 1913, Queen's Univ., completed requirements excepting Thesis for D.Sc. degree from Mass. Inst. of Tech., 1919-20; 1913-14, foreman, elec. and hydraulic test dept., Canadian Allis Chalmers, Lachine; 1914-18, overseas. Lieut., Can. Engrs., Wounded three times. Awarded D.C.M.; Lecturer, Queen's Univ., 1917-18, elect'l engr'g., 1918-19 and summer session 1919, elect'l engr'g. and math., 1920-21, asst. professor and acting head of dept. of elect'l. engrg.

References: F. F. Miller, L. W. Gill, A. Macphail, W. P. Wilgar, D. S. Ellis.

KIDD—WILLIAM SIDNEY, of Mattawa, Ont. Born at Burritts Rapids, Ont., Dec. 12th, 1893; Educ., B.A Sc. (Honours), Univ. of Toronto, 1920; 1913-14, (summers), dftsman, chief arch'ts. branch, D.P.W., Ottawa; 1916-19, overseas; 1919 (9 mos.), dftsman, D.P.W., Ottawa; April 1920 to date, dftsman and designer on pulp mill work with Riordon Co. Ltd., Mattawa, Ont.

References: G. L. Freeman, J. A. Beauchemin, C. D. Norton, R. de la B. Girouard, C. R. McCort, C. R. Young, P. Gillespie.

LACOUTURE—JOSEPH ALFRED, of Montreal, Que. Born at Marlborough, Mass., Jan. 14th, 1882; Educ., Polytechnique, Montreal. Armour Inst. of Tech., 1900; 1901-05, 2 yrs. asst., 2 yrs. chief dftsman., La Cie Pontbriand Ltée.; 1905-07, chief dftsman., Beauchemin & Co.; 1907-09, struct'l work, Cambria Steel Co.; 1909-11, engr., Fore River Ship Co.; 1911-17, govt. shipyard. 4 yrs. as supervisor of works; 1917-20, Canadian Vickers; Since March 1921 with Montreal Water Board, Steel Struct'l. Works.

References: J. C. DesBaillets, F. Y. Dorrance, F. E. Field, J. F. Brett, R. W. Mitchell, A. Duperron.

LAMBERT—WALTER, of Montreal, Que. Born at Warwick, England, Jan. 31st, 1884; Educ., 2 years West Ham Tech. Inst., London, England. Served ap'ticeship in ship drawing office, The Thames Iron Works, London and The Londonderry Shipbldg. & Engr'g. Co., Ireland; 2 years, ship dftsman., Armstrong Whitworth & Co., Newcastle-on-Tyne; 8 years, ship dftsman, J. I. Thornycroft & Co., Southampton, England, 2 years in charge of foreign work designing office; 4 years, mgr. to Canadian office John Reid & Co., Naval Archt. & Marine Engrs., Montreal; 2½ years, naval archt. & asst. director of shipbldg. to the Imperial Munitions Board, Ottawa; 1½ years and at present in business for self as consltg. naval archt.

References: P. L. Pratley, E. A. Forward, S. L. deCarteret, StG. J. Boswell, G. E. Newill, R. W. Leonard, A. Welch, H. M. Belfour, H. S. Davison.

LANCTOT—THEO, of Hull, Que. Born at Montreal, Que., Aug. 15th, 1884; Educ., C.E. Ecole Poly. (Laval) June 1908. 10 yrs. in munic. engr'g. City of Montreal; 2 yrs. engr. with J. E. Vanier, Montreal; 1 year supt'g. engr. Can. Highway Eng. Ltd. At present time City Engr., Hull, Que.

References: G. C. Gale, J. E. Vanier, F. C. Laberge, G. R. MacLeod, S. J. Fortin, U. P. Boucher.

LANG—JOHN LEIPER, of Sault Ste Marie, Ont. Born at Hyde, England, Aug. 18th, 1884; Educ., B.A.Sc., Univ. of Toronto, 1907. D.L.S., O.L.S.; 1908 to date (with exception of 1916-19 when overseas) in private practice. 1908-09, Lang & Keys, 1910, Lang Keys & Ross and 1910 to date Lang & Ross. (1911 to present time, dist. engr., Northern Development Branch.)

References: R. S. McCormick, T. R. Loudon, P. Gillespie, C H. Rogers, G. F. Horsey, E. L. Cousins.

LATTA—WILLIAM, of Lachine, Que. Born at Edinburgh, Scotland, Aug. 25th, 1884; Educ., Dumbarton School of Science and Art.,Glasgow and West of Scotland Tech. Coll.; 1899-1905, ap'ticeship, civil engr'g dept. and phys. testing lab., Wm. Denny & Bros., Leven Shipyards, Dumbarton; 1905 (May-Sept.), works engr., Argyll Motors Ltd., Alexandria, Scot.; 1905-06, drawing office, nitrate plant dept., Mechan & Sons, Scotstown, Scot.; 1906-07, detailer, Dominion Bridge Co., Lachine; 1908-09, asst. to T. Ditchburn, C.E., Dumbarton, Scot.; 1909-11, dftsman., Brown Machine Co., New Glasgow, N.S and Cleveland Bridge Co , Montreal; 1911-13, checker and squad boss, Canada Foundry Co., Toronto; 1913-14, checker, National Bridge Co., Montreal; 1914-15, charge hand (D.O.), Sir Wm. Arrol & Co., Glasgow, Scotland, also Oct. 1919 to Sept. 1920; 1915-19, charge of civil engr'g. dept. and phys. testing laboratory, Wm. Denny & Bros., Leven Shipyard, Dumbarton; At present, checker, Dominion Bridge Co., Lachine.

References: W. C. Thomson, F. P. Shearwood, A. Peden, D. C. Tennant, K. K. Pearce.

LUMBERS—WILLIAM COOPER, of Toronto, Ont. Born at Toronto, Ont., Mar. 5th, 1877; Educ., Grad. S.P.S., Univ. of Toronto, 1901. 1901, dftsman. and machine work, Ballantyne & Co., Preston, Ont.; 1902-03, dftsman., C.P.R. Toronto; 1904-08, instr'man. for City Engr., Calgary, and dftsman. and instr'man. for div. engr. C.P.R., Calgary; 1912-16, dftsman and instr'man. for Frank Barber, Toronto; 1916, inspection on munitions; 1917 to date asst. engr., Barber, Wynne-Roberts and Seymour.

References: F. P. Adams, N. E. Brooks, G. G. Powell, F. W. Thorold, A. P. Walker, R. O. Wynne-Roberts.

MARTIN—JOHN LAWRENCE TASSIE, of Montreal, Que. Born at Montreal, Aug. 11th, 1893; Educ., B.Sc. (M.E.), McGill Univ. 1914; 1914-15, dftsman, Cedar Rapids Mfg. & Power Co.; 1915-17, dftsman, Shawinigan Water & Power Co.; 1917-19, asst. engr. with above company; 1919 to date, asst. engr., Shawinigan Engineering Co., Montreal.

References: J. C. Smith, F. T. Kealin, S. Svenningson, G. K. McDougall, E. Brown.

McCOY, LOUIS EDWIN, of Montreal, Que. Born at Portland, Oregon, U.S.A., June 18th, 1885; Educ., B.S. in E.E., Univ. of Oregon, 1911; 1911-12, electrical install'n., Portland Rly. Light & Power Co., and April to Oct. 1912, operating and mtce. work for same company; 1912-17, power house supt., Alaska Treadwell Gold Mining Co., Treadwell, Alaska; 1917-19, chief electr'n., Alaska Electric Light & Power Co., Juneau, Alaska; Aug. 1920 to date, engr. dftsman, Shawinigan Engr'g. Co. Ltd., Montreal.

References: J. C. Smith, F. E. Amlie, F. T. Kaelin, S. Svenningson, J. Morse.

McCRADY—LOUIS DE BERNIERE, of Montreal, Que. Born at Charleston, S.C., U.S.A., Nov. 26th, 1885; Educ., B.S. in C.E., Clemson College, 1909; private study naval arch'ture & Marine engr'g.; 1 summer, mach. shop, Valk & Murdock's Iron Works, Charleston, S.C.; 1909 with city engr. Charleston & later Bethalem Steel Co's Shipyard, Wilmington, Del.; 1909-10, dftsman in engr'g. dept., duPont Powder Co., Wilmington, Del.; 1910 (Mar.-July), asst. res. engr., at above company's plant at Barksdale, Wis.; 1910-11, res. engr. in charge of engr'g. and constrn. of above plant; April 1911 sent to Canada by du Pont Company to renovate, install modern equipment etc. for plants purchased by Canadian Explosives Ltd. 1913 appointed asst. chief engr. of this company and from 1918 to date chief engineer.

References: A. B. McEwen, D. Bremner, G. R. MacLeod, J. A. Shaw, E. G. M. Cape, J. T. Farmer, M. D. Barclay.

McCRORY—JAMES ALEXANDER, of Montreal, Que. Born at Pittsburg, Pa., U.S.A., Dec. 5th, 1880; Educ., B.S., Penna. State College, 1907; 1907-08, mech. dftsman, Crucible Steel Co. of America; 1908-10, mech. dftsman., Bureau of Filtration, Pittsburg, Pa.; 1910-16, designer, Trussed Concrete Steel Co. of Canada; 1916-19, asst. engr., Shawinigan Water & Power Co.; 1919 to date, office engr., Shawinigan Engineering Co., Montreal.

References: J. C. Smith, F. T. Kaelin, S. Svenningson, F. E. Field, G. K. McDougall.

McDOUGALL—CECIL BURDETTE, of Caledonia, N.S. Born at Osborne, N.S., Aug. 7th, 1882. Educ., High Sch. and I.C.S. course ry. eng. 1903-12, with Davison Lumber Co. Ltd., Bridgewater, N.S., 2 yrs. as rodman and instr'man. and 7 yrs. res. engr. in charge of railway location, constrn. and mtce. Springfield Ry.; 1912 (6 mos.) C.N.O. div. dftsman.; 1912-17, res. engr. on constrn. I.C.R., Dartmouth-Deans Br.; 1917-19, on active service (Capt. tech. officer in charge of workshops C.F.C.); 1920 (9 mos.), res. engr. Davison Lumber & Mfg. Co.; At the present time res. engr. N.S. Wood Pulp and Paper Co. Ltd.

References: W. A. Hendry, L. H. Wheaton, J. L. Allan, P. B. Duff, F. W. Forbes, A. L. McDougall.

MILLER—EBEN CARLYLE, of Toronto, Ont. Born at Montreal, Mar. 1st, 1889. 1908 to date with T. Pringle & Sons, Engrs., Montreal as follows: 1908-09, ap'tice & dftsman, 1909-10, res. insp'r. on bldgs. in Toronto, 1910-12, res. insp'r and in head office, Montreal, 1912, opened branch office in Toronto and from 1912 to date engr. in charge of Toronto office. Responsible for design and supervision of numerous buildings.

References: R. J. Fuller, E. H. Beck, G. F. Evans, W. W. Gunn, A. Pringle, J. S. Costigan, G. M. Wynn.

NEWELL—JOSEPH PETTUS, of Montreal, Que. Born at Portland, Oregon, May 11th, 1866; Educ., C.E. Course M.I.T., 1884-87. 1887 with Cincinnati Southern Ry., as dftsman and instr'man on constrn., Port Townsend Southern Ry. Co.; 1893-07, asst. engr. and later div. engr. i/c mtce. on constrn. relocation and laying out spiral curves; 1907 to date, in private practice, among other works designed and built 10,000 acre irrig'n. project in central Oregon, consl. engr., Oregon Public Service Com., consl. engr., (1918) dept. of Rlys. and Canals C.N.R. Arbitration; at the present time consl. engr., dept. of Rlys. and Canals in G.T.R. Arbitration. (M.A.S.C.E.)

References: R. A. C. Henry, J. G. Sullivan, V. I. Smart, F. W. Cooper, M. A. Fullington, F. P. Moffatt, G. H. Ferguson.

OATLEY—HENRY BIGELOW, of New York, N.Y. Born at Rochester, N.Y., Sept. 8th, 1876; Educ., B.S., Vermont, June 1900; 1900 to 1910 Amer. Locomotive Co., on Locomotive Design Testing and Research; 1910 to date with the Superheater Co., in responsible charge of Design of Superheaters; in direct charge of Superheater Design for Amer. Locomotive Co. and Superheater Co. for 15 years; Vice-President Superheater Co.

References: Wm. H. Winterrowd, Wm. F. Drysdale, H. H. Vaughan, A. C. Loudon, Chas. M. McKergow.

OMMANNEY—GEOFFREY GREAM, of Montreal, Que. Born in England, Dec. 9th, 1879; Educ., Engr'g. Faculty, King's College, London, England. Passed exam. for Assoc. Member, Inst. Civil Engrs., 1899. Elected A.M.I.C.E., 1905, M.I.C.E., 1914; 1902-06, harbour works in England, Ceylon, Singapore and West Coast Africa; 1906-09, survey, harbour, rly. and general engr'g. work, C.P.R.; 1909-11, in charge of constrn. of all harbour and wharf work connected with Port McNicoll Great Lakes Terminal for C.P.R.; 1911-12, in charge of survey and exploration work, Vancouver Island, C.P.R.; 1912-15, special engr. to the President, C.P.R. (Official appointment—1914); 1915-19, overseas. Lieut. and Major, Royal Engrs.; At present investigation engr., Dept. Colonization & Development, C.P.R.

References: J. M. R. Fairbairn, J. S. Dennis, P. B. Motley, D. Hillman, F. W. Cowie, J. W. Orrock, M. J. Butler, A. D. Swan, J. E. Armstrong.

PATTERSON—ALEXANDER ERNEST, of Longueuil, Que. Born at Montreal, Que., Feb. 20th, 1888; Educ., B.Sc. McGill Univ., 1915. 2 seasons asst. engr. on roads, town of Longueuil; 1 season Quebec Streams Comm. on hydrogr. surveys; 1 season in charge of party for Chicoutimi Pulp Co. on hydrogr. surveys; 1918 to date, M. and S. C. Ry. in charge of mtce. structures and buildings.

References: H. M. MacKay, E. Brown, O. Lefebvre, R. DeL. French, H. A. Gibeau.

PEARSON—GRANT PRICE, of Clandeboye, Man. Born at Schomberg, Ont., May 15th, 1894; Educ., B.A.Sc., Toronto, 1918, also Preliminary D.L.S. 1915; 1915-16, Rodman and Draughtsman with J. W. Tyrrell, C.E.; 1918, D.L.S. Asst. on Municipal Observation Work; 1918-19, Asst. Engr. Dominion Water Power Branch; 1920, 4 mos., Asst. to Municipal Engineer, Municipality of Springfield; Oct. 1920 to date, Municipal Engr., Municipality of St. Andrews.

References: C. H. Attwood, M. C. Hendry, M. A. Lyons, Peter Gillespie, W. H. Hunt, J. W. Tyrrell.

RALEY—CHARLES, of Lethbridge, Alta. Born at Barnsley, Yorkshire, England, Oct. 14th, 1860; Educ., Wesley Coll., Sheffield, 1875-76, and articled pupil to Taylor & Senior, Archs. & Civil Engrs., Barnsley, England. 1881-82, in charge of sewage filtration works, Worsbro, Yorks; 1882-83, on the enlargement of Wortley Water Works; 1884, sub-division work in Sask. under H. Stevens; 1885-86, non-professional work; 1886-99, dfting in Ottawa; 1900-12, ch. dftsman and office engr., Alberta Rly. & Irrig. Co.; 1912 to date, office engr., Dept. of Natural Resources, C.P.R. (Member A.P.E. Alta. Fellow Arch. I.C.)

References: S. G. Porter, A. S. Dawson, H. B. Muckleston, G. G. Anderson, C. A. Magrath, C. M. Arnold, B. Ripley, H. W. Meech.

REED—HARRY ROLAND, of Parry Sound, Ont. Born at Markham, Ont., Feb. 16th, 1892; Educ., B.A.Sc. University of Toronto 1920; Since 1913-15, mtce. work H.E.P.C. on high tension; June 1920 to date supt., power plant, Parry Sound, Ont.

References: E. A. James, T. Louden.

ROBERTS—ALEXANDER, Jr., of Peterborough, Ont. Born at Dunbarton, Scotland, July 25th, 1891. Educ., Dunbarton Burgh Acad., Morrison Acad. (Crieff). Engr'g. certs. from Dunbarton Sch. of Science and Art, 1910-14, apprenticed mech. engr. Paul & Co. Ltd., Dunbarton; 1914-19, on active service, part of time as workshop officer; 1919-20, dftsman. with W. Denny Bros., Ltd., shipbldrs. and engrs., Dunbarton. At the present time designer and dftsman with Wm. Hamilton Co. Ltd., Peterborough, Ont.

References: R. B. Rogers, P. P. Westbye, R. H. Parsons, W. G. Munn, G. R. Langley.

ROOT—BERTWELL C., of Westmount, Que. Born at Westbrooke, Me., U.S.A., May 22nd, 1876, 15 years in charge of designing and manufacturing pulp and paper mill machinery. 3 years as asst. to gen. mgr. of Improved Paper & Machinery Co., Nashua, N.H. Came to Canada 12 years ago representing the above company. Built the factory of the Sherbrooke Machinery Co. Ltd., also designed and built addition to same. Also designed several new machines for the pulp industry which are installed in nearly all pulp mills in Canada, having had charge of all engr'g. work connected with same. Jan. 1918 formed connection with Hydraulic Machinery Co. Ltd., Montreal, as mgr. of the pulp & paper mill division, being directly responsible and having had charge of designing several new machines.

References: J. J. O'Sullivan, H. S. Ferguson, G. F. Hardy, J. S. Costigan, J. A. DeCew, G. D. MacKinnon, E. A. Jamieson, T. L. Crossley, M. A. Sammett.

ROSTRON—JOHN ROBERT, of London, Ont. Born at Stockport, England, Dec. 13th, 1867; Educ., Manchester Tech. Coll. Private tuition in Engr'g.; 1883-88, designing, estimating, dfting and surveying etc. on various works for London & North Western Rly.; 1897-1905, asst. engr. on many large engr'g. works for above company; 1905-10, asst. engr., New Stallbridge Dock, Garston, Liverpool and dredging deep water channel in bed of River Mersey; 1910-14, asst. engr., North London Rly. (England); 1915 to date, asst. engr. on special works to H. A. Brazier, City Engr., London, Ont.

References: H. A. Brazier, H. S. Philips, W. E. Stephens, E. I. Leonard, R. R. Knight, N. L. Crosby.

SANGER—JOHN WILLIAM, of Point du Bois, Man. Born at Bristol, England, Dec. 19th, 1886; Educ., Faraday House Engineering College, London, England. 5 yrs. dist. supt. Midland Electric Power Co., England; 1 yr. City Light and Power Dept. Wpg., engineering office; 1 yr., 1912-13, Supt. of distribution City Light and Power Dept., Wpg.; 1913-15, engr., Wpg. dist. office, for Siemens Co. of Canada, Ltd.; 1915 to date, supt. power house, City Light and Power Dept., Wpg.

References: E. V. Caton, W. M. Scott, J. M. Leamy, G. L. Guy, J. A. Douglas, R. S. Lea, J. G. Glassco, J. Rocchetti.

SCOTNEY GEORGE—LOUIS S., of Kamloops, B.C. Born at Calcutta, 19th Feb., 1881; Educ., Private tuition and Battersea Polytechnic Science School 1896; I.C.S. Course Surveying and Levelling; 1900-12, irrigation practice in British Columbia; discharged from Army in 1916; 1916-17 on technical construction of airships with Armstrong Whitworth Co., (England); 6 mos. aeroplane work for British Government; at the present time Asst. Engr. with Dom. Water Power Branch at Kamloops.

References: R. G. Swan, C. G. Cline, A. M. Phillips, C. E. Webb, E. C. Thrupp.

SCOVIL—STUART SOUTHMAYD, of Ottawa, Ont. Born at Kenora, Ont., May 17th, 1886; Educ., B.Sc. (Honours), Queen's Univ., 1912; 1908 (summer), Alta. Govt. Road Surveys; 1910 (summer), assembly dept., Canadian Westinghouse, Hamilton; April 1912, asst. engr., Man. Hydrographic Survey, Dept. of the Interior, Winnipeg; 1913, asst. chief engr., Manitoba Hydrographic Survey; 1914-19, chief engr. to the Lake of the Woods Technical Board, Dept. of External Affairs, Ottawa; 1920 to date, engr. to Lake of the Woods Control Board on regulation of Lake of the Woods and senior asst. engr. Dominion Water Power Branch, Ottawa.

References: J. B. Challies, J. T. Johnston, W. J. Stewart, H. G. Acres, S. J. Chapleau, L. W. Gill.

SEGRE—BERESFORD HENRY, of Toronto, Ont. Born at Savannala Mar, Jamaica, B.W.I., Feb. 19th, 1886; Educ., B.A.Sc., Univ. of Toronto, 1912, D.L.S.; 1907 to date with Dom. Lands Surveys, in different capacities and since 1912 chief of party. Was on active service, Lieut., R.E.

References: P. Gillespie, G. H. Ferguson, E. P. Bowman, G. C. Cowper, A. L. Cumming, G. H. Herriot, W. D. Walcott, T. V. McCarthy.

SEYMOUR—WILLIAM, of Sault Ste Marie, Ont. Born at Marshall, Michigan, U.S.A., Oct. 14th, 1881; Educ., B.S. Univ. of Michigan, 1904. 1904-11, with Grand Rapids Gas Light Co., Grand Rapids, Mich., and for the last four years supt. of manufacture; 1911-16, with Algoma Steel Corp., as foreman, asst. supt. and later supt.; 1916-17, operating supt. H. Koppers Co., Pittsburgh, Pa.; 1917-18, with Bethlehem Steel Co., Bethlehem, Pa. as asst. supt. coke ovens; 1918 to date, supt. coke ovens Algoma Steel Corp.

References: B. E. Barnhill, F. M. Perry, W. F. McFaul, N. Somers, L. R. Brown.

SHENSTONE—FREDERICK ROBERT, of Bamfield, B.C. Born at Calgary, Ireland, April 10th, 1888; Educ., Bach. of Engr'g., Univ. of Ireland, 1910; 1909-10, asst. to P. J. Prendergast, A.M.I.C.E., county surveyor, Galway; 1910-11, asst. and 1911-12, chief asst. to P. H. McCarthy, C.E., M.I.C.E., Dublin; 1912 (4 mos.) rodman, C.P.R. constrn.; 1912 (July-Dec.), topog'r. and leveller, Dept. of the Interior; 1913-16, hydrographic engr., irrig. office, Dept. of the Interior, Calgary; June 1920 inspr. for D.P.W. Canada. Repairs to Bamfield wharf; At present ranching. (Obliged to temp. leave civil engr'g. in 1916 owing to breakdown in health.)

References: F. H. Peters, P. M. Sauder, T. M. Montague, W. H. Greene, H. R. Carscallen, G. R. Elliott, P. J. Jennings.

STALFORD—VICTOR KENNEDY, of Hamilton, Ont. Born at Toronto, Ont., Aug. 20th, 1889; Educ., I.C.S. elec. engr'g. diploma. Served ap'ticeship as electric wireman; 1908-10, operating engr., steam elec. power plant; 1910-14, plant elect'l. engr., Canadian Westinghouse, Hamilton; 1914-15, chief elect'l. inspr., City of Hamilton and from 1915-19, chief elect'l. dist. inspr. under H.E.P.C.; 1919 to date, private practice as consltg. and supervising elect'l. engr., Hamilton.

References: P. M. Smith, E. R. Gray, E. H. Darling, J. A. McFarlane, H. B. Dwight, A. R. Macpherson, R. L. Latham, W. F. McLaren, J. Erskine.

STEPHENSON—JOHN, of Sydney Mines, N.S. Born at Skelmersdale, Lancashire, England, Feb. 20th, 1889; Educ., 1st year mech. engr'g., Wigan Mining and Tech. Coll., Wigan, England. 4 years even. tech. schools, Prov. of N.S.; 1907-09, rld. constrn., concrete work etc. for various companies in Canada and U.S.; 1911-14, dftsman, for N.S. Steel & Coal Co. Ltd., Sydney Mines; 1914-15, foreman, heat treating dept., shell plant, N.S. Steel & Coal Co. Ltd., Sydney Mines; 1915-19, dftsman. for above company; 1919 (Jan.-Nov.), dftsman, Halifax Shipyards Ltd.; 1919-20, dftsman, Algoma Steel Corpn., Sault Ste Marie; April 1920 to date, designer, Nova Scotia Steel & Coal Co. (Instructor for Dept. Tech. Education, Nova Scotia, 1918-19, prep. maths., 1920-21, mech. drawing.)

References: D. H. McDougall, G. D. Macdougall, T. J. Brown, W. Rodger, B. E. Barnhill, A. W. Sinnamon.

STOTT—JOSEPH DUNCAN, of Lachine, Que. Born at Lymm, Cheshire, England, Feb. 14th, 1892; Educ., Tech. Coll. Paisley, Scot.; 1907-09, ap'ticeship with The Wolseley Tool & Motor Car Co. Ltd., Burmingham; Nov. 1912, shops and drawing office, Bow McLachlan & Co. Ltd., Paisley; 1912-14, asst. engr. in charge of outside mill repairs, Healey Bros., Manchester, England; 1914-16, in charge of section of shops, The Fairfield Shipbldg. & Engr'g. Co. Ltd., Glasgow; 1916-18, on design of cranes and lifting gear, H. Morris Ltd., Loughborough, England; 1918-19, layout and erection of oil plant, Ardol Ltd., Selby, England; 1919-20, on design of cranes etc., with J. M. Henderson & Co., Aberdeen, and Armstrong & Main Ltd., Glasgow; At present on design of cranes etc., with the Dominion Bridge Co., Lachine.

References: J. T. Farmer, F. Newell, R. H. Findlay, T. A. Chubb, K. O. Whyte.

THOMPSON—GEORGE HARRY, of Calgary, Alta. Born at Oxford, Nova Scotia, May 11th, 1890; Educ., B.Sc. in E.E. McGill University, 1913; 1907-09, on ry. constrn. and hydro elec. work; 1909-13, (summers) std. apprentice Can. Westinghouse Co., Hamilton; 1913-16, erecting engr. on elec. and steam equip. Can. Westinghouse Co., Alta.; 1916-19, on active service in France; 1919 to date, sales engr., Can. Westinghouse Co., Alta; (office in Calgary.)

References: F. K. Beach, F. E. Emery, R. MacKay V. A. Newhall, R. S. Trowsdale, G. H. Whyte.

TOBIAS—GEORGE ALEXANDER, of Niagara Falls, Ont. Born at Hamilton, Ont. Oct. 26th, 1893. Educ., B.Sc. (Hons.) Queen's Univ. 1918. 1910-11, dftsman. Can. Westinghouse Co.; 1911-14, dftsman. Hamilton Bridge Wks. Co.; summer 1915-16, with Can. Copper Co., Copper Cliff, Ont., surveying and dfting; 1917, Dominion Bridge Co., checker on structural steel details; 1917-19, with C.E.F., Lieut. in Can. Engrs.; 1919-20. with Dominion Bridge Co., checker on structural steel details; 1920-Apl. 1921, asst. plant engr. Dominion Engineering Wks. and Dominion Bridge Co., in charge of office work and preparation of plant and estimates and design of equipment. At the present time with Hydro-Elec. Power Comm., Niagara Development, on design of temporary structures and constrn. of plant equipment.

References: P. L. Pratley, A. Peden, G. H. Duggan, C. H. Timm, G. R. Turner, D. C. Tennant.

WALSH—WILLIAM E., Jr., of Galt, Ont. Born at Greendale, Mass., U.S.A., Mar. 4th, 1899; Educ., Montreal Tech. School, 1913-15; 1915-16, dftsman, H.E. shell dept., Steel Company of Canada; 1916-18, chief dftsman, Roelofson 'Mach & Tool Co. Ltd., Galt, Ont ; 1918 to date, chief dftsman., R. McDougall Co. Ltd., Galt

References: J. A. McFarlaoe, D. T. Black. M. U. Ferguson, F. H. Midgley, F. P. Adams.

WATSON—ROBERT GEORGE, of West Wabana, Nfld. Born at Buckhurst Hill, Essex, Eng., Sept. 22nd, 1880; Educ., Attended classes at Robert Gordon's Tech. Coll. during 6 year ap'ticeship (inc. 1 year drawing office) Jas. Abernethy & Co., Engr. etc., Aberdeen; Passed Board of Trade, 1st class cert., Marine Engrs.; 1903-09, with Houlton Bros. & Co. Ltd., Shipowners, London, as 6th, 4th, 3rd and 2nd refrigerator engr., 1st class Board of Trade cert.; 1909-10, asst. mech. supt., Measham Collieries Ltd., England; 1910-11, asst. works mgr., and 1911-12, mech. supt. (Kansaoski Copper Mine), Tanyaaika Concessions Co., Africa; 1912 to date, with Nova Scotia Steel & Coal Co. Ltd., Charge of repair dept., New Glasgow, 1914-18, supt. of power plant & shipping plant, Iron Ore Mine, Wabana, Nfld., and 1918 to date, mech. supt. same mine.

References: R. E. Chambera, A. R. Chambers, C. B. Archibald, J. B. Gilliatt, J. B. Petrie.

WHITTAKER—HERBERT JAMES, of Calgary, Alta. Born at Liverpool, England, July 27th, 1894; Educ., Univ. of Liverpool, England; Asst. to R. D. Norris, Surveyor and Engr. to the Prescott District Council; Prior to War instr'man., Dominion Western Rly.; 1915-19, overseas. 1915-17, engr'g. staff, C.O.R.C.C., 1917-19, Lieut., acting as engr. officer, 57th Hy. Seige Bty. On return was instructor in math. for engr. pupils, vocation school, Calgary; 1920 (temporary position), instr'man in charge of plane table party, irrig. divn. reclamation service; At present engaged in private enterprise of professional nature.

References: G. W. Craig, G. N. Houston, A. S. Chapman, W. J. Gale, F. M. Steel, J. E. Woods.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

CARRUTHERS—ALEXANDER LORRAINE, of Prince Rupert, B.C. Born at Sarnia Township, Ont; Educ., 2 yrs. Honor Natural Science, 1 yr. S.P.S. Univ. of Toronto 1901-04; 1904-11, with Can. Nor. Ont. Ry., 1904-05, rodman, concrete inspr. and instr'man, 1905-06, bridge inspr. and instr'man, 1906-11, res. engr.; 1911, (March-Oct.), res. engr. and Oct. 1911-17, Divisional engr Can. Nor. Pac. Ry.; 1917 to date district engr. D.P.W. Province of B.C.

References: T. H. White, D. O. Lewis, S. H. Sykes, A. F. Stewart, A. E. Foreman, P. Phillip.

JACOBS—LLEWELLYN C., of Montreal, Que. Born at Manchester, England, Dec. 13th, 1884; Educ., B A. (Math.), Univ. of Manitoba, 1905; 1902 and 1904 (summers), rodman on surveys; 1905-06, locations surveys, N.T.C.Ry.; 1907, instr'man, 1908-11, res. engr., N.T.C.Ry. constrn.; 1913 to date, with the Foundation Company as engr. on constrn. work, supt. of constrn., and since 1919 gen. supt. of constrn. at Montreal.

References: R. E. Chadwick, C. W. Allen, A. Allaire, P. B. Motley, J. A. Heaman, R S. McCormick, G. F. Richan.

SMITH—ALBERT WILMOT, of Winnipeg, Man. Born at Coverdale, N.B., April 13th, 1884; Educ., B.Sc., McGill Univ., 1910; 1909 (summer), bridge erection, Dominion Bridge Co.; 1910 (summer), in charge of plane table party for C.P. Irrig. Dept.; 1910-12, dftsman. and designer and 1912 to date designing engr., C.N.R.

References: H. A. Dixon, J. G. Legrand, W. Walkden, T. Turnbull, W. Burns, T. W. White, A. H. Legge.

FOR TRANSFER FROM THE CLASS OF JUNIOR TO A HIGHER GRADE

DODGE—CLINTON LOWELL, of Lethbridge, Alta. Born at Colorado Springs, Colo., May 18th, 1887; Educ., B.Sc. in civil and irrig. engr'g. at Colorado State College, 1911; 1909-10 (summers), canal rider, U.S. Reclamation Service; 1911-20, hydrometric and irrig. engr., C.P.R., D.N.R., Strathmore, Alta. Apr. 1920 to date, res. engr. of constrn. of irrig. canals and ditches, Lethbridge Northern Irrigation District.

References: H. B. Muckleston, R. S. Stockton, A. S. Dawson, C. M. Arnold, P. M. Sauder, E. N. Ridley, G. N. Houston, F. S. Dyke.

MAWHINNEY—DAVID MILTON, of Stonewall, Man. Born at Holland, Man., March 17th, 1890; Educ., three years engr. course, University of Man.; 1909-13, with G. M. Gest, contractor as timekeeper, material clerk asst. on constrn. engineering and constrn. enge,, on H. T. Conduit work, city of Winnipeg and for Winnipeg Elec. Rly., (Underground constr'n.); 1914 res. engr. Winnipeg Elec. Rly., Stony Mountain, Stonewall; 1915-16, substation operator at Stony Mountain; 1916 to date munic. engr. for the munic. of Rockwood.

References: M. A. Lyons, P. Burke-Gaffney, H. R. Urie, W. E. Hobbs, W. H. Jones, E. E. Brydone-Jack.

MORGAN—PHILIP HAROLD, of Strathmore, Alta. Born at Ebbw Vale, Eng., March 15th, 1889; Educ., Ebbw Vale Grammar School and private tuition; 1906-10, pupil Ebbw Vale Steel, Iron & Coal Co. Ltd.; 1910-12, asst surveyor same firm; 1912, five months dftsman engr. dept. C.D.R. dept. of Natural Resources; 9; 2-; 4, office engr. C.P.R., D.N.R. Strathmore; 1914-19, on active service Imperial Army (Capt. Adj.); 1919-20, office engr. C.P.R Strathmore; At the present time hydro. C.P.R. Strathmore.

References: A. S. Dawson, H. B. Muckleston, R. S. Stockton, G. P. F. Boese, F. K. Beach, G. H. Patrick, E. N. Ridley.

READ—CHARLES GEORGE, of Halifax, N.S. Born at Teddington, England, April 6th, 1892; Educ., London Univ., Archt'l., civil and constrn. course, 1908-10; 1911-14, rodman, instr'man., dftsman. and res. engr., mtce. location and constrn., C.P.R.; 1914, topog'r. and dftsman., C.N.R.; 1914-15, engr. in charge of constrn. and mtce. of highways, England, France and Scotland for British Westrumite Asphalte Co., London, England and Road Board, London, Eng.; 1915-18, engr. and surveyor in charge of surveys, layouts, constrn. and designs of National Filling Factory for Ministry of Munitions and War Office, England; 1918, engr. and surveyor in charge of constrn. for J. G. White & Co. (War Office work); 1919 (3 mos.), dftsman., W. J. Francis & Co. Ltd., Montreal; 1919-20, dftsman. on mtce., C.N.R., Levis, Que.; 1920 to date, with Prov. Highways Board of Nova Scotia, as dftsman, designer, and at present res. engr. on design & constrn.

References: W. A. Hendry, J. E. Belliveau, R. W. McColough, J. W. Roland, C. A. MacNearney, J. M. Millar.

FOR TRANSFER FROM THE CLASS OF STUDENT TO A HIGHER GRADE

DOBBIN—WARREN LESLIE, of Toronto, Ont. Born at Minneapolis, U.S.A., July 3rd, 1891; Educ., B A.Sc., University of Toronto, 1916; Military engr. certs., Can. Active Militia, up to 1912 Rodman etc., with C.N.R.; 1913-14, instr'man and in charge of party, Dept. of P.W., city of Toronto on roadway branch; 1915, Inspector and instr'man on concrete constr'n. Welland Ship Canal; 1916-19, Capt. Can. Engrs. in France; 1919-20, asst. town engr., Oshawa, Ont.; At the present time engr. and asst. supt. Grant Contracting Co., Toronto.

References: H. E. T. Haultain, C. L. Haya, R. O. Wynne-Roberts, P. Gillespie.

FOREMAN—JOHN LEONARD, of Ottawa, Ont. Born at Collingwood, Ont., Oct. 8th, 1888; Educ., B.A.Sc. (Honors) S.P.S. Toronto 1914 (C.E.) specializing in concrete and hydraulics; Summer 1907, estimator etc., on timber berth surveys; 1909, four months on steel ship constr'n. Collingwood shipyards; Summer 1910, on twsp. surveys; Summer 1911, asst. engr. on concrete bridge constr'n.; Summer 1912, instr'man, C.N.R.; Summer 1913, and two months 1914, asst. engr. on Harbour Improvements, D.P.W.; 1914-18, hydrog'r. surveyor dept. Naval Service; 1918-19, Lieut. R.N.V.R.; July 1919 to date hydrog'r. surveyor dept. of Naval Service.

References: W. J. Stewart, J. G. Sing, P. Gillespie, C. F. Hanington, N. E. D. Sheppard, J. R. Bissett.

LOGAN—WILLIAM HECTOR, of Beaverton, Ont. Born at Beauly, Scotland. June 13th, 1897; Educ., High School and I.C.S. rly. engr.; 1917-18, with the Canadian Rly. troops in France; 1919-20, rodman etc., on rly. location C.N.R.; At the present time unemployed.

References: W. Burns. L. E. Silcox, F. G. Haven.

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World Shipbuilding

History, ship framing, types of modern steamship, modern ship propulsion. Canada as a shipbuilder.

H. R. McClelland, A.M.E.I.C.

Read before The Engineering Institute of Canada, Montreal Branch, March 24, 1921.

Early Shipbuilding

In considering, briefly, early shipbuilding, the writer will confine himself principally to British shipbuilding, in which, after all, we are probably most interested as a Canadian Institution.

The first historical record of British shipping is found about A. D. 973, and, so far as we know, the vessels in existence at that time were about fifty or sixty tons, single masted, and with one sail.

In 1066, a date which is surely engraved in the minds of every one of us, Harold gathered a fleet to repel the landing of William, later known as the "Conqueror". The Crusades gave quite an impetus to shipbuilding, as Richard, "The Lion Hearted", used vessels to transport his troops and horses to Palestine.

Early in the 13th century we find the first known record of the use of a compass, and about the year 1300 of the use of a rudder, vessels previously having been steered by oars on the sides and quarters.

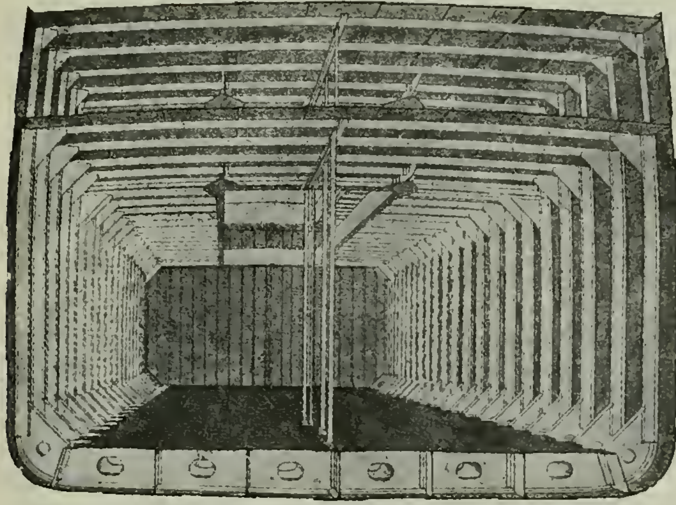
It was not until about the time of Elizabeth that sailing vessels approached the type with which we are all familiar, and then, about the year 1800, steam was applied for propulsion. This was not the first introduction of steam power for this purpose, but it was not until 1800 or 1801 that the use of steam was seriously considered as a means of propulsion for traders and cargo carriers.

We have all heard of the clipper ships, and the era of their first and greatest fame extended from about 1840 to 1855. Great speeds were frequently obtained by these clippers, and few people, unless those who have studied the matter, realize what they were capable of doing in the way of speed. As examples, we have authentic records to prove that the ship "Flying Cloud" made a run (which was duly verified) of 433 nautical miles in twenty-four hours, or in other words, 18 nautical miles per hour, which approximates very closely the daily average of our best Atlantic liners of to-day. Another ship the "Sovereign of the Seas", is recorded as having made 419 miles in the same period of time, or 17½ miles per hour. It should be noted that these records were made entirely by sail power. Both these vessels were built in the United States.

About 1870 the great revolution in ship design and construction began, and the dimensions and tonnage of vessels increased by rapid strides. In addition, the use of sails alone was dispensed with more and more, and the use of steam increased, with the result, as we now know, that the grand old sailing ship, with all the romance and tradition which were attached to her, has gradually fallen into disuse, and is now looked upon, more or less, as a curiosity, except in certain special parts of the world, of which the coasts of Nova Scotia, New Brunswick and Maine are amongst the outstanding.

Early Steamships

Before leaving the ancient days, it will be of interest to recall that the first steamboat built in the North American Continent was the "Clermont", built by Robert Fulton in the United States, in the year 1807. Two years later, or about November 1809, the second steamboat constructed in the North American Continent was built at Montreal, by Mr. Molson. This vessel was known as the "Accomodation", and inaugurated a passenger service by water between Montreal and Quebec. Those of us who are apt to criticise existing facilities for travel should remember that this particular vessel took about 36 hours to make the journey between the two cities, doing so with the aid of an engine of about 6 horse power.



Single deck Cargo Vessel designed on ordinary Transverse System without Side Stringers;
Dimensions: 399 ft. x 50 ft. 8 in. mld. x 28 ft. 3½ in. mld.

The change from the vessels mentioned, to the floating palaces of to-day is startling. We have emerged definitely from the vessel with restricted accomodation, small stuffy rooms below decks, the ever present smell of bilge water and the attendant discomforts. Looking back over the period which we have been considering, one cannot help but be profoundly impressed by the wonderful extent of the developments which have taken place, whether one considers the general question of hull construction and arrangement, or whether one refers to the details of equipment and luxurious furnishing.

The introduction of the use of iron, and later on of steel, revolutionised ship construction, and made possible the leviathan of to-day. It has also made possible a high degree of specialization in types, to satisfy the different trades. This is evidenced by the development, as compared with the old type cargo vessel, of the present day vessels for the carrying of bulk cargoes such as meat, grain, and oil.

Ship Framing

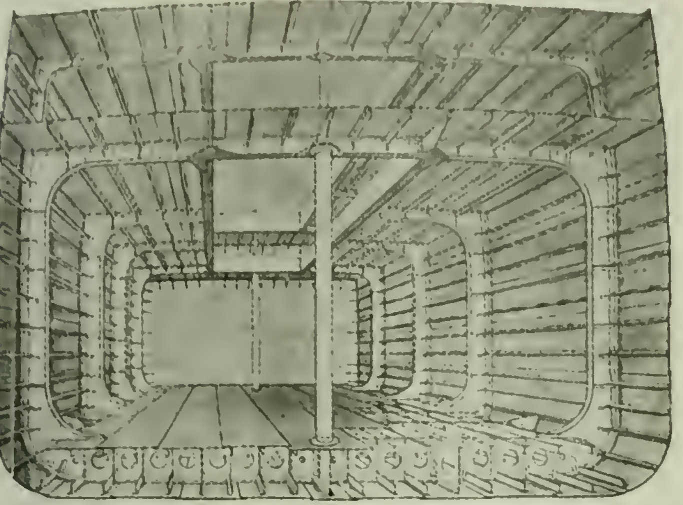
In the main, present day ship construction is divided into two basic systems, one transverse framing and the other longitudinal framing, the latter system being used, almost exclusively, in the construction of vessels intended to carry what are known as bulk cargoes.

For many years naval architects have devoted their energies to scientific research into the subject of stresses and strains to the end that unnecessary weight might be dispensed with and strength retained where most required. By so doing, the carrying capacity of the modern steamship has been enormously increased, without, in any way detracting from her strength or seaworthiness, and it is now apparent that, in the early days of ship design, vessels were constructed vastly heavier than was really necessary. The merits or demerits of the design of a cargo vessel are largely dependent upon two features — one suitability for the specific purpose for which she is intended, and the other the cost of construction. To-day we feel that we have about reached the pinnacle of the economical construction of steel vessels. That the feature of the suitability of design is being properly looked after is well substantiated by the fact that a vessel of 10,000 tons can now be built with holds more free from obstruction and with greater facilities for working cargo than a 4,000 ton vessel of twenty-five years ago.

Let us consider first, the general cargo carrying vessel. The consensus of opinion among experts in ship handling and operation is in favour of a vessel of about 8,800 tons deadweight carrying capacity, including coal and stores. One outstanding type of vessel of this size is known topically, as the "Robert Dollar" type, for the reason that about the first of this type was built on the Clyde, to the order of the well known West Coast Shipowner of that name. So suitable was this type for general cargo carrying purposes, that it was adopted as a standard by the United States Shipping Board. These vessels are about 410′-6″ long by 54′-0″ broad by 29′-9″ deep, being built on the transverse framing system. One of the types built by the Canadian Government which is practically a duplicate of one of the British standard types is very similar to the "Robert Dollar" type, being about 500 tons less in deadweight carrying capacity. Vessels of these types were built in large numbers during the last five years, being propelled by either reciprocating or geared turbine engines.

Standardization and the Fabricated Ship

During the War it was in connection with the general cargo carrying vessel that the principles of multiple production and, what is known as fabrication, were for the most part applied. This was done to a much greater extent by the United States than by any other country, probably for the reason that the United States had only a comparatively small amount of experienced shipbuilding labour in proportion to the magnitude of the programme of building ships upon which that country embarked.



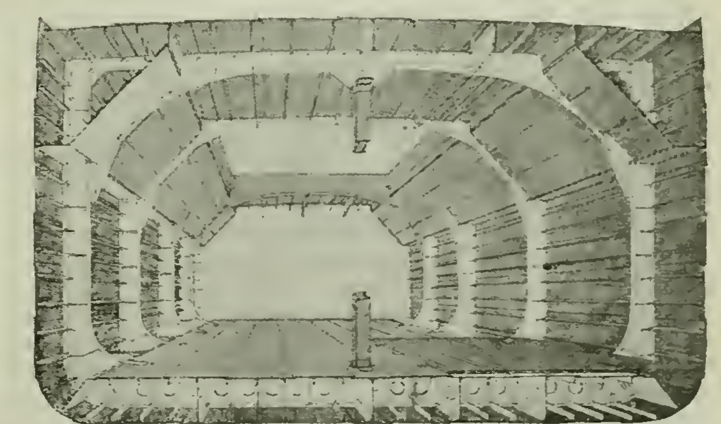
Single deck Cargo Vessel designed on the Longitudinal System.
Dimensions: 399 ft. x 50 ft. 8 in. mld. x 28 ft. 3½ in. mld.

In Great Britain, the advent of the War necessitated a certain amount of standardization in the types of ships constructed, this being a direct contradiction of the established principles of British shipbuilders and shipowners. British shipowners in the past, by virtue of their enormous experience, have decided for themselves the particular type of vessel which they have desired and which they knew would be the most suitable for their own trade. In fact, one well known British shipowner has made the statement that the real great step forward in the development of the British Mercantile Marine was made when the shipowner began to stipulate to the shipbuilder the type of vessel he required to be built. Whether that is true or not does not matter, though it is a fact that in no country have the owners of ships demanded closer attention to their own ideas from ship designers and builders than they have in the United Kingdom.

During the War this practice had to be dropped and standardization introduced. To-day, however, standardization is almost entirely discarded, and shipowners, particularly British shipowners, are now once more going out for the vessels which meet their own particular requirements.

The standardization of types, which reached its pinnacle in the United States in 1918, made possible the advent of the fabricated ship. Standardization and the resulting use of the fabricating principle made it possible for practically all the steel entering into the construction of large numbers of vessels to be prepared for erection in the ship, in some cases thousands of miles from the place where the ship was being built. Furthermore, this practice distributed employment broadcast and utilized practically all workshops in the country which were in any way equipped to handle steel. In addition, parts of the equipment of vessels were manufactured in the most out of way places, for instance, engines were built in Colorado for ships being built in Georgia. In Great Britain the same practice obtained but to a lesser degree owing, principally, to the unrelenting and hidebound attitude of the British Trades Unions, and the stand they took on the questions of demarcation between different trades and what was known as dilution of labour. The War was directly responsible for the recrudescence of the building of wooden ships. Not the old type windjammer to which our thoughts turn when we think of wooden vessels, but steamers ranging from 3,000 to 4,000 tons deadweight carrying capacity. These wooden vessels have, unfortunately, been a failure principally owing to the fact that the use of unseasoned lumber and the inexperience of most of the men who built the vessels were coupled with the use of heavy machinery with its inevitable vibration. In any case, the construction of wooden vessels of large size and with heavy propelling machinery can only be termed an emergency effort and all credit should be given to those who produced them in such large numbers during the War, even though when completed they were so far from being successful. As one critic remarks, "the spirit was willing, but the timbers were unseasoned".

Before leaving general cargo vessels, it might be mentioned in passing that the much discussed concrete vessel which gained world wide prominence during the later years of the War, has now, for the most part, gone out of existence except for barges and such uses. The opinion of the vast majority of shipping men is, that there is no commercial future in concrete vessels as ocean-goers, as records show when over 100 feet in length, a concrete vessel is heavier than a wooden or steel vessel of similar size, and, as a ship is built to carry cargo, everything which detracts from her carrying capacity is an economic loss.

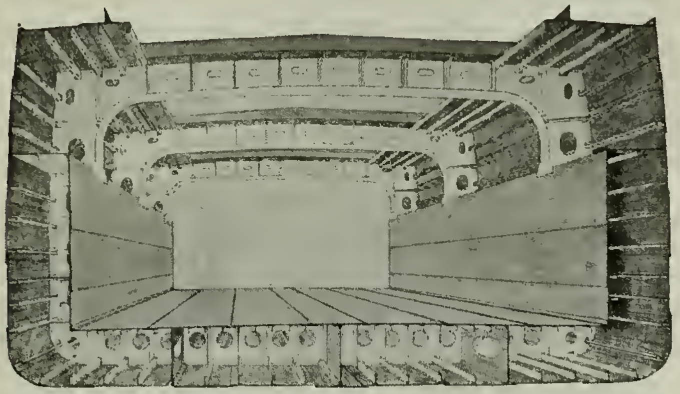


Single deck Colliers Rose Castle and Lord Strathcona built on the Longitudinal System.
Dimensions: 455 ft. x 57 ft. 9 in. x 33 ft. 9 in. mld.

The preceding remarks apply to what we call the general cargo vessel which, in brief, is a vessel designed and constructed so as to be capable of transporting, with reasonable economy, cargoes of almost any description.

Special Purpose Vessels

Vessels which are employed in a regular specific trade are usually specially designed for that trade. For instance, vessels in the coal and ore trades have self trimming hatches and topside ballast tanks and, in the case of vessels engaged in these trades on the Great Lakes, the hatches are arranged to be at the same centres as the chutes ashore on the docks. The advantage of building vessels specially for such trades is evidenced by the fact that, on the Great Lakes a 10,000 ton vessel has been loaded with a full cargo of ore in twenty-three minutes, the average time for loading a vessel of this size being from one hour to one hour and thirty minutes. A 10,000 ton ship can be loaded with coal in from five to six hours, and a record has been made in unloading one vessel with 10,073 tons of soft coal on board in six hours and thirty-five minutes.



Great Lakes Freighter W. Grant Morden, built on the Longitudinal System.

Dimensions: 604 ft. x 59 ft. x 32 ft. mld.

The transporting of frozen and chilled beef has necessitated the development of a very special type of cargo vessel, and this development has taken place within the last forty years. The first vessel to carry a cargo of frozen meat to Great Britain was the "Strathleven", and this was in the year 1881, the cargo being 34 tons. To-day there are over 300 vessels under the British flag fitted for the carrying of chilled beef, and the last available figures we have were in 1913 when 730,000 tons were imported into Great Britain.

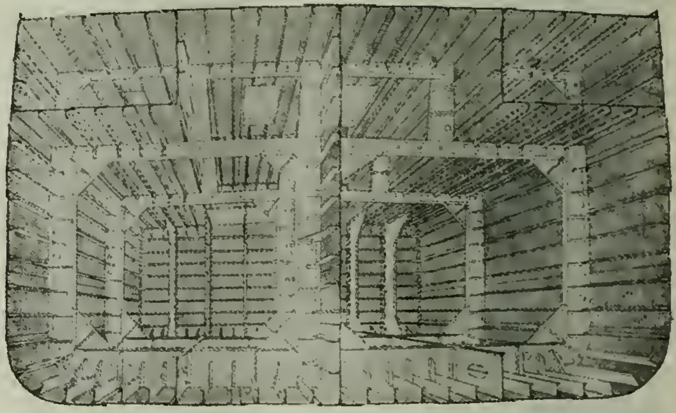
Owing to the large amount of special equipment, insulation, etc. required on a vessel of this class, and also owing to the method in which such cargoes must be carried, the largest chilled meat carrier afloat to-day only carries 4,700 tons in her cold chambers, as a general cargo carrier the same vessel would carry about 10,000 tons. It is interesting to know that practically the whole of the world's carrying trade in chilled and frozen meats is performed by ships under the British flag.

The United Fruit Company runs a fine fleet of steamers, some of these being in the perishable fruit trade. Most of these ships are registered under the United States flag, but, apart from this company, the fruit carrying trade is also largely under the British flag. This, of course, is due primarily to the extensive foreign and tropical possessions which are held by the United Kingdom.

Some of the later units of the Canadian Government fleet have been equipped in a small way with refrigerating machinery for cargo purposes, being capable of carrying about 200 tons of chilled meat.

We are all interested these days in the transporting or, at least, in the using of oil. In no branch of shipbuilding have greater strides been made than in the specialized vessels for the carrying of oil in bulk. The first tank steamers, it is interesting to recall, were simply converted cargo vessels, internal tanks being fitted to contain the oil, the latter not being in contact at any point with the structure of the hull. During the War this principle of using internal tanks was very extensively adopted, because oil was an imperative necessity to our carrying on of the War and tank steamers, so called, were hopelessly few. The result was that general cargo steamers had to be converted, in large numbers, into oil carriers.

The oil tanker, designed and built purely and solely for the carrying of oil in bulk, is a very special product of the ship designer's art. In fact many shipyards have been disinclined to go into tanker construction, because of the many difficulties such construction presents. In an oil tanker, or indeed any vessel used for the carrying of bulk and particularly bulk liquid cargoes, longitudinal strength is the prime factor. This factor has been well taken care of by the adoption of what is known as the longitudinal system, developed to a great extent by J. W. Isherwood, the inventor of the "Isherwood System" of ship construction.



Oil tank Steamer designed on the Longitudinal System.

Dimensions: 420 ft. x 54 ft. 6 in. x 32 ft. 9 in. mld.

There are many points of difference between what is called the transverse system and the longitudinal system, but the main feature is, that in the transverse system, the frames or ribs of the vessel run in a transverse or thwarthship direction, whereas in the longitudinal system, they run longitudinally or fore and aft. There are many other technical differences which need not be elaborated upon in a paper of this kind.

Oil tank vessels are, as already stated, very carefully built and necessarily so. It is well known that oils, particularly petroleum, respond readily to change in temperature and modern oil tankers are constructed with expansion trunks on all tanks. These trunks permits the oil to expand, and as they are built to some height above the tank top level, they also permit the oil to contract without the level of the top of the oil getting below the level of the top of the tank itself. Such a condition would produce what is called a "slack" tank, which is a potential source of danger when a vessel is in a seaway, and which is apt to cause leakage by disturbing the riveting and caulking.

The largest oil tanker afloat to-day has a carrying capacity of 18,000 tons, and vessels to carry 20,000 tons are now in course of construction.

Passenger Vessels

World shipbuilding has made no greater strides than in passenger vessels. It would be superfluous to go into detail about the equipment, so far as passenger comfort is concerned, of the present day liner, or even of the smaller passenger boat. We have all been amply familiarized with the craze which calls for elaborately decorated public rooms, private suites with a reserved portion of the deck as an additional inducement, swimming baths, etc., etc. All these wonders of the shipbuilders' and ship-decorators' arts have resulted in giving us to-day a truly luxurious means of ocean travel, the only consideration being the cost.

It may be stated here that it is questionable if any more of these floating palaces will be constructed for many years to come. Such enormous vessels require enormous crews and call for high operating costs. Little or no space is devoted to cargo, and therefore the only revenue is from the passengers. All evidence goes to show that these ocean leviathans can not be made to pay, and no one, not even the shipowner, can afford to operate at a loss. Consequently, the tendency to-day is towards the one class boat, or the two class boat, of smaller dimensions and with considerable cargo carrying capacity. The multi-millionaire may still crave for his luxuries, but, from present indications, the shipowner, particularly the trans-oceanic shipowner, is going to cater, in the future, to a larger element of the travelling public.

For this reason, unless the costs of operation are revolutionized by some new development, it is to be doubted whether this generation will see any more "Aquitanias" or "Olympics" constructed. The records of the White Star Line, so far as the profits on individual ships are concerned, would probably, almost certainly, confirm the poor earning qualities of the vast passenger liner of to-day. Compare the "Olympic" of 46,000 gross tons with the "Adriatic" of 24,500 gross tons. There is hardly a doubt that the latter vessel is a profit maker, whereas it is very questionable if the "Olympic" can be run without a loss. Anyone who has travelled on both the vessels named will confirm that the "Adriatic" is really the more comfortable ship, is a good sea boat, and has all the luxuries the ordinary man desires. Other similar comparisions might be made, and it is needless to say that the shipowner must inevitably stake his money on the type of vessel which will bring him in the greatest returns.

The construction of the huge liners such as the "Aquitania", "Imperator" and "Vaterland" was the result, to a great extent, of a competition between Great Britain and Germany for the blue ribbon of the Atlantic, —surely the most costly ribbon for which nations or individuals ever competed. The present condition of national finances precludes, for many years, a resumption of these competitions.

At one time ships were far ahead of all existing harbour facilities, particularly as regards draft. Now that has been changed. Generally speaking, channels and canting spaces are ample in depth and width for the vessels they are called upon to accomodate. The building of vessels 1000 feet in length and over while, not at all impossible, is, as has been stated, improbable, and, therefore, the existing drafts of channels, if maintained, should be ample for many years to come. In all probability when that time does come and more leviathans of the deep are called for, the use of air craft may have developed to such an extent that the thoughts of transportation and terminal men will be developed to hangars rather than to wharves and freight sheds.

Intentionally this paper has not contained, so far, many figures or statistics, but, before passing on to consider very briefly the other side of the ship construction business, that is Marine Engineering, it may be interesting to know that during the year 1920, a total of 3,233 vessels having a total tonnage of 6,884,875 and a total Indicated Horse Power of 6,097,780 were added to the world's floating equipment. This was a drop of about 927 vessels, of about 1¾ million tons and of about 3 million Indicated Horse Power from the totals of the preceding year.

Welding in Shipbuilding

No paper on shipbuilding, however general, would be complete without a reference to the part which welding, both oxy-acetylene and electric, has played in the last few years. It is not so long ago since we heard of the great welding jobs performed by the French, Swedes and Germans with admiration and wonder. The French were the pioneers in welding by the oxy-acetylene process, and as far back as 1907 had a plant at Lyons which was really the home of the industry. To that plant several men from Great Britain were sent and were trained, returning to Great Britain and establishing the industry there. To the Scandinavian countries and Germany must be given much of the credit for the advance in the electric welding process. It is perhaps, unpleasant, but none the less true that in British repairing plants as late as 1912, practically all the electric welding was done by foreigners. either Germans or Scandinavians. Later on, of course, local men became educated and electric welding, which has now almost superseded for all general purposes all other methods, has become so general that it is commonplace. Whereas up till four or five years ago welding was confined, so far as ships are concerned, almost entirely to boiler repairs, now we find the electric welder at hundreds of small jobs all over the ship. For the most part his services are only called for where strength is not a great consideration, and where the main idea is just to fill up. This may be unjust prejudice on the part of ship men, but there it is. In spite of this prejudice the so-called welded ship has become an actuality, and one vessel which was completed during the year 1920, by the firm of Cammell Laird & Company of Birkenhead, England, has attracted a great deal of attention in shipbuilding circles. Not only is this vessel, the "Fullagar", electrically welded throughout, but she is also fitted with an internal combustion engine of a novel type.

It is useless to speculate as to the future of the application of welding to ship construction. Much has already been done, extensive researches have been carried out and the advancement to-day, as compared to five years ago, is marvellous. In these days of rapid development, he is a foolish man who condemns utterly anything which is novel or which, at first sight, appears to him impractical. It may seem a flight of the imagination to consider the building of a huge ocean-going vessel entirely without rivets. Obstacles which seemed just as impossible and impractical at one time, have been attacked and the difficulties surmounted, so we must be careful in our statements as to the future possibilities of any new idea which, at the moment, may seem to us to be little better than experimental.

Developments in Marine Engineering

On the purely engineering side of ship construction, there have been immense strides within recent years. The marine steam engine has passed through a gradual evolution, commencing with the single cylinder simple engine and passing through the successive stages of compound, triple expansion and quadruple expansion. The simplicity and reliability of the ordinary reciprocating steam engine, make it, even in these advanced days, probably the most satisfactory unit for propelling the ordinary medium sized vessel.

Turbines have been very extensively adopted for ship propulsion particularly in high powered and fast passenger steamers. It has been said that if a vote were taken amongst those interested in British shipping as to who conferred the greatest good upon the industry as a whole, the vote would be in favour of "Parsons", the inventor, or at least the adaptor to commercial uses, of the steam turbine.

Turbines are in common use on board steam ships in various ways:

(1) All turbine drive, with the turbines directly connected to the propeller shafting.

(2) The combination system, where turbines are used in conjunction with ordinary reciprocating engines, the exhaust steam from the low pressure end of the latter, being passed into a turbine where the last remnants of its expansive properties are utilized before finally reaching the condensing plant.

(3) The system in which turbines drive the propeller or propellers through specially designed and constructed gearing either of the single or double reduction type.

(4) The electric drive in which the turbines are used for the generation of electric current which, in turn, is used to drive the propeller shafting through motors.

Our neighbors in the United States, have, in the last couple of years, become very enthusiastic in the use of electric drive. Several units of the United States Navy are propelled by electric machinery, and, within the last few months, some cargo vessels have also been fitted with this type. Though the results so far have been satisfactory, we are scarcely in a position to say whether or not electric drive for ocean-going cargo or passenger vessels is a commercial success, as, owing to the peculiar conditions under which ships operate and the sudden emergencies they, and those on board of them, are frequently called upon to face, it is only by long experience that the merit or otherwise of this method of propulsion can be determined. Naval vessels, are, of course, in a class by themselves.

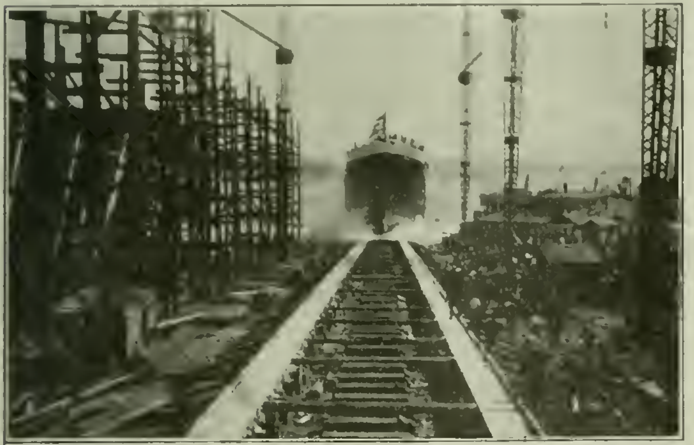
Within the last decade, the use of oil as fuel on board vessels has increased by leaps and bounds. According to last year's records, the number of vessels afloat using oil in oil-fired boilers is 16.3 per cent, and of those using oil in internal combustion engines 1.7 per cent. Of the remaining world tonnage of size above 100 tons, 76 per cent use coal as fuel, and 6 per cent have sail power only.

There are many adherents to-day to the use of Diesel and semi-Diesel type engines on board ships. Personally, the writer is of the opinion that the development of this type of machine for marine purposes is one of the most outstanding achievements of recent years. There are many arguments put forward by the supporters of this type of propulsion, most of which are reasonably sound. Lord Pirrie, the world renowned head of Harland and Wolff, and a magnate of shipbuilding and engineering, after making a tour of oil fields in the Southern States and Mexico, suggested that it was almost a crime for any power user to consume oil in oil-fired steam boilers or in any other manner than directly in a motor engine. Decided advantages accrue by the use of internal combustion engines in the way of increased deadweight capacity (owing to the absence of boilers), economy in fuel, upkeep and personnel.

Comparing steam engine driven vessels with internal combustion engine driven vessels, one is forced to admit the advantage in favour of the latter. From established records it is known that the most efficient steam-driven turbine and geared machinery of say 3000 shaft horse power will not consume less than one pound of oil per shaft horse power per hour for all purposes, whereas with an internal combustion engine driven ship of equal power utilizing an economical system of auxiliary driving, the figure is less than ½ pound of oil per hour per shaft horse power for all purposes, a saving of at least 50 per cent.

Taking a vessel equipped with a Diesel of say 4000 Brake Horse Power, the oil consumption in pounds per hour per horse power is about .45. A reciprocating engine of about 4700 I.H.P. would be required for the same vessel, if using coal the consumption would be about 1.6 pounds per horse power and oil about 1.14 pounds per horse power per hour. A geared turbine of about 3900 shaft horse power would require 1.4 pounds of coal and 1.0 pound of oil per horse power per hour. The nearest competitor to the Diesel with its .45 pounds of oil per hour per horse power is thus the geared turbine with its 1.0 pounds of oil per hour per horse power.

A great revival has taken place in regard to Superheating. It is rather surprising to remember that the steamer "Great Eastern", that famous product of the brains of Brunel and Scott Russel, which was built in 1858, was equipped with Superheaters. For many years after the "Great Eastern", Superheaters on board ocean-going vessels seem to have fallen into disuse, until the revival of seven to ten years ago. Since then the use of Superheaters has increased enormously, and to-day many different types, all with advantages and some with disadvantages, are in use. It seems now as though the advantages and economy of superheating steam were beyond doubt and the use of some kind of superheating equipment is gradually becoming universal.



Launching of S.S. "Canadian Mariner" at Halifax

The Old-Time Engineer

We must, however, never lose our respect and admiration for the old type engineer, immortalized by Kipling, who succeeded in keeping his machinery running when it seemed physically impossible for him to do so. Covered with oil from head to foot, usually involved in arguments with firemen or trimmers, McAndrew was a type by himself, full of resource and frequently on the lookout for vacuum, which seems to have been the bane of the engineer Kipling portrays. In the midst of all our new ideas, let us not forget the foundation laid by the old timer, with his compound engine and low pressure boiler. The intimate knowledge of his machine which he possessed has borne such fruit that, to-day, we find very strong prejudices against the adoption of, what we are pleased to call, more modern equipment.

Admiral Lord Charles Beresford, whose memory is dear to everyone with British blood in their veins, once made the following comments on the old sailing navy, and his remarks apply equally well to the Mercantile Marine, even in these days of steam and oil — "The Navy provides the finest possible mental and physical training. It teaches initiative, presence of mind, accurate observation, habitual defiance of danger, ready resource and an extraordinary hardihood. At sea a man holds his life on the condition that he possesses these qualities. Frequent emergencies are part of the ordinary routine, and the penalty of failing to meet them is inevitable. There is no arguing with a gale of wind."

Canada as a Shipbuilder in the War

Canada has played a great part in establishing herself as a definite partner in the great business of World Shipbuilding. From sources which are considered reliable, we learn that in 1863 a total of 602 vessels with a tonnage of almost 225,000 tons were constructed in Canada, including the Maritime Provinces. It is evident that in those days this country did quite a large business in the building of ships and selling them to other countries. In 1874 the number of vessels constructed had dropped to 487 with a tonnage of 190,000, and from that time on, the fall was gradual until in 1915 the number was only 246, with a tonnage of about 19,000 tons. The use of iron and steel in the construction of vessels was largely responsible for the shrinkage in Canada's output, as, until a few years ago, iron or steel shipbuilding was a very small factor in the country's business.

In certain sections of the Maritime Provinces and Pacific Coast, wood shipbuilding is still quite an important industry, but the tonnages turned out are small and do not mean much in tables of statistics.

The needs of Canada and the Mother Country in the war made the development of the shipbuilding industry in Canada a very real and vital necessity. Now that we have been placed in possession of some actual facts regarding the war situation, it is undoubtedly proved that the crux of the whole affair lay on the sea, and that, if the submarine campaign had gone on unchecked and had achieved that success which, at one time, it seemed almost certain to achieve, there could only have been one ending.

Canada constructed in, for the most part, newly developed Canadian Shipyards a large number of patrol vessels, the first one being delivered in October, 1917. A total of sixty trawlers and one-hundred drifters were constructed, and these vessels rendered yeoman service in patrolling duties in Canadian waters and in other parts of the world. In addition, large numbers of submarines, motor driven scouts, etc., were built in this country and used in various zones of warfare. The Davie Shipbuilding Company, at Quebec, constructed a fleet of about fifty light draft barges for Mesopotamia. These were taken apart at Quebec and re-erected in Mesopotamia and proved so satisfactory that Lord Allenby, the General in Command of the Eastern campaign wrote Mr. Davie a personal letter complimenting him on the work the plant had done, stating that the Canadian built boats had been the best of all the boats sent over.

The Imperial Munitions Board carried through an extensive programme of ship construction which resulted in the completion of much useful cargo carrying tonnage during the later years of the war.

There has been a great deal of talk about the Canadian Government Merchant Marine. The writer is not a politician, and is therefore for that reason not much exercised as to the wisdom or otherwise of this Government owing a Merchant Shipping fleet. This fine fleet was projected in the darkest days of the war, and vast sums of money were invested in shipyards and allied industries in order to construct and to deliver to the Government cargo carrying vessels for which the whole world, at that time, was clamouring. The total cost of the whole Government programme of sixty-three ships of about 380,000 tons deadweight is around $72,818,000.00, or, in other words, the cost to Great Britain of about two days warfare as practised in the year 1918. The cost per deadweight ton ranged from $167.50 to $215.00, according to size, and these were fair average prices at the time the orders were placed.

The Future of Shipbuilding in Canada

To-day about fifty ships are in actual operation, not a single vessel of the fleet being laid up. They may not all be making money, but it would be no disgrace to the men who are operating them if they were not making money under the present conditions of freights and international commerce. Everyone of these fine, well designed and well built vessels has the word, "Canadian" as a part of her name, and therefore acts, in some measure anyhow, as a means of propaganda for this growing country. The writer has been very proud on different occasions to see in New York Harbour, a Canadian owned, Canadian designed, Canadian built and Canadian operated vessel flying the Canadian flag at her stern, a worthy example of the strides Canada has made in ship construction.

Every citizen and resident of this great Dominion of Canada, this wonderful country which is capable of such tremendous development, who has the interests of the Dominion at heart, should lend his aid, where possible, towards stimulating and fostering the shipbuilding industry in our midst. A country cannot live to itself, and overseas commerce is as vital to its existence as light and air are to its inhabitants. It is not to be questioned that Canadian products should be carried to the uttermost parts of the world, and surely they should be carried in Canadian vessels if it is possible to do so. The proud position of the British Empire to-day is attributable in no small measure to her wonderful Mercantile Marine, and to the foresightedness of the men who direct it now, and have directed it in years gone by.

No one can find fault with Canada as a nation for endeavouring to carry her own products in her own ships. Our friends across the border have the same end in view, and we have no right to expect them to think or act differently. Competition is good in most lines of business, and is certainly no detriment in the building and operating of steam boats.

Our interest, however, as *The Engineering Institute of Canada* is primarily Canadian, it would be very strange if it were not so. It is our duty, therefore, to stimulate our local industries, and in stimulating them, to do our share in helping to make them more efficient, so that the trade mark "Made in Canada" — whether it be on beaver board or ships — may be a sign of excellence and superiority.

So far as the building of ships is concerned, the world now knows that Canada *can* build ships. We, who are connected with ship design and construction in Canada, ask the co-operation and assistance of our colleagues in the allied professions, to the end that the ground Canada has gained in this business may not be utterly lost. Wages must come down, cost of materials and of living must come down if we are to be on anything like an equal footing with our competitors.

All lines of business, more or less, are suffering from depression, and this is not peculiar to Canada. This depression will pass away, however, and business will inevitably improve. Let us be sure that we are ready and equipped in every way when the day of improvement comes, we, in the ship game, are doing the best we can to keep things moving.

Ship Propulsion

Modern methods of ship propulsion, reciprocating engine, steam turbine, internal combustion engine, and the electric drive.

T. C. Phillips, M.E.I.C.

Read before Ottawa Branch, The Engineering Institute of Canada, February 17th, 1921.

The subject the writer has the honour of presenting is one of such magnitude and radius, that the time at our disposal will only permit of a more or less general review. The subject, of course, is taken from its mechanical standpoint, and endeavour will be made to shew the progress from its inception to the present time.

Here is shewn a print of these war galleys as used by the Roman Navy.

James Watt was a pioneer of Great Britain in the development of the steam engine. He indicated his accurate conception of the expansive properties of steam by publishing the principles of this action in 1769. It was not, however, until the first year of the nineteenth century that the steam engine was applied afloat as motive power in Great Britain; mechanical propulsion is then a product of the nineteenth century.

The first passenger ship (steam driven) to be operated in Europe is said to be the "Comet"; she had regular sailings between Glasgow and Greenock. Her dimensions were 41′ x 11′ x 5½′, having 1-11′ cylinder 16″ stroke.

The first mechanical propulsion of ships was by means of the side lever engine driving side or stern paddle wheels. This type was abandoned later (owing to the large amount of space required) in favour of the direct acting engine.

Between 1840 and 1850 tubular boilers were introduced which enabled the pressure to be raised to 15 lbs. These were known as rectangular or tank boilers.

Much of the naval opposition to mechanical propulsion was broken down by the adoption of the screw propeller, which came in between 1840 and 1850; this means doing away with the great disadvantage of the paddles in a fighting ship. The screw propeller—which we will endeavour to explain at greater length later—had been invented long before, but its practical utility does not appear to have been recognized due probably to the slow moving engines of that period, as will be understood. This means of propulsion called for higher speed to attain that speed of ship obtained by paddles and up to that period no engines had been produced of sufficient speed to allow for direct connection of the engine to screw shaft, the trouble had to be met by the fitting of gearing — not quite the same as we understand it today — the crying need today is to keep the propeller revolutions down, then it was to keep them up.

It was at this time that the horizontal engine made its appearance, and owing to the limited room available it had to be constructed on the trunk principle.

Returning to the horizontal geared trunk engine, difficulties were found in maintaining the large trunk steam tight, so this type gave way in the larger vessels to the usual type of piston rod engine. Pressure now carried reached 20 to 25 lbs. and enabled the engines to turn at sufficient speed to permit of their being directly connected to the screw shaft. These engines registered a great advance on previous designed being fitted with jet condensers.

Surface condensation came in about the year 1860, being an advance of far reaching importance. Cylindrical boilers soon followed. The gain realized from higher steam pressure and the expansion of steam was soon recognized, with the results that steam pressures were raised to 60 lbs. From 1870 on, compound engines were generally adopted, the benefits by compounding shewing a saving of over 30% in fuel. increased regularlity of turning movement with a consequent reduction in stresses, also less weight per H.P.

As the power of the compound engine increased, the dimensions of L.P. cylinder became so great, that it became necessary to fit two cylinders instead of one and the three cylinder compound came into being. With steam pressures of over 100 lbs. variation of temperature in each cylinder of the compound again became too great, therefore the full economy due to high pressure was not effected due to condensation and so the three cylinder compound developed into the Triple Expansion with the resultant advance in economy and efficiency; later came the four cylinder Triple and Quadruple Expansion.

Passing on from the reciprocating engine in the service, we come to the Direct Rotary Engine the Steam Turbine. This development was introduced in the United Kingdom by Sir Charles Parsons and the first vessel equipped with this type of engine was known as the "Turbinia".

The adoption of the steam turbine in the navy was complete, not so in the mercantile marine, where the great majority of cargo carriers today still retain the reciprocating engine.

Screw Propellor

There is one similarity in all ships today regarding the outboard means of propulsion in that the screw propeller has been recognized universally as the best medium for transmitting power to the water as a means of driving the ship ahead or astern. It is today the one doubtful factor in the whole arrangement of power transmission at sea, that is to say, there are so many factors to nullify its true operation, that we have no guarantee that the screw designed will adequately fill the bill when fitted to the full size ship. These conditions will be the more clearly understood when considering the complex action of the waters in which the propellers revolve.

When a body in the form of a ship is submerged in a fluid and moves through the fluid in the direction of its length, the fluid opens out in front, moves aft along the body in what is known as "stream lines" and closes in at the stern, the pressure exerted by the fluid at the fore end of the ship being nearly balanced by that at the stern. These stream lines are of perfectly defined form, but differ according to the shape of the body or ship. In all cases of ordinary fluids, the body must be oval or similar to ship form for perfect stream line motions, projections or sharp corners disturb these stream lines, adding to the resistance.

In the actual case of a ship moving through water, considerable resistances to motion take place due to the fluid possessing a certain amount of viscosity, the surface of the ship not being frictionless, the formation of eddies because of the imperfect shape of the body and the formation of waves as the ship is on the surface, by the viscosity of the water is meant, that with water in motion the friction among the particles of the fluid tends to resist any change of form or distortion. Frictional resistances increase directly with the area of wetted surface and as the cube of the speed. As a ship goes through water, the rough surfaces cause a dragging action, causing a motion of the adjacent water in the same direction as the ship is moving, at something like 7% to 10% of the speed of the ship according to the condition of the wetted surface. The loss due to eddy making is generally small and is due to the varying velocities set up by the dragging action of the ship. The particles of water roll over so to speak and react upon each other; in a similar manner the action of the propellers set up another series of eddies due to the blades acting obliquely on the water and the frictional drag of the blade surfaces. Waves may be divided into two kinds; the divergent waves thrown off by the ship from the bow and sides which are a loss of energy and the following wave at the stern, which partly assists in the forward motion of the ship and is not therefore all lost power. Wave making depends largely on the entrance and run of ship and while comparatively unmiportant at low speeds absorbs considerable power at high speeds. Another feature in screw propelled ships is the additional resistance due to the action of the screw in diminishing the pressure at the stern. The depth of water also materially effects the efficiency of the propeller. Tests taken with destroyers of the river class shew a loss of 1 knot in water at 100 feet depth as compared with a depth of 240 feet and a further loss of 2 knots at 50 feet depth. Cavitation, an action due to high pressure per square inch of blade surface as a consequence of high pheripheral speeds is a preventable loss. In direct driven turbine destroyers, where high speeds are necessary to obtain the required power with small propellers, this has been most marked. Cavitation as the name implies is the forming of cavities at the back of the blades, due to the failure of the atmospheric pressure — due to high speed — to follow the blades with a pressure of water.

It will be appreciated, therefore, that the difficulties to be overcome in allowing for all the disturbing elements, which take place at the stern of the ship, in attempting to provide reliable data for the design of this medium are complicated and far reaching.

The action of the screw propeller is a subject in itself and deserves much greater study and consideration than can be gone into tonight. The general design of the propeller you all know. The reasons responsible for the number of blades, diameter, surface, pitch and the various ratios are multiple and result from the special requirements in each case.

The elementary duties of the propeller is to transmit the shaft Horse Power to the water, that is to say the shaft Horse Power overcomes the resistance of the ship by the projecting of streams of water known as the race of the propeller. This power at the screw is known as the Effective Horse Power and is proportionate to the product of the speed of advance and resistance; it will be remembered that the influence of the screw extends sufficiently far forward to cause a diminution of pressure at the stern, thereby adding to the resistance and Effective Horse Power required.

As explained, a great deal of mystery is associated with propeller design. Taking the action of a propeller as a pump, and applying Newton's Law of action and reaction being equal and opposite, it will be clear that there cannot be discharge without suction, and suction or a clear flow of water to the propeller is most difficult to get; and it is here, in the opinion of the writer, that the root of the trouble lies, through the disturbed and complex action of the waters due to the various causes already explained. If it were possible to so place the propeller that an unbroken steam of water to it could be assured free from all the disturbing elements at present met with, much of the mystery would doubtless disappear.

Steam Turbine

The turbine is an engine where the efficiency advances directly with the speed or revolutions; the propeller, generally speaking, attains its maximum efficiency at low speeds, from which will be seen that two opposed efficiencies are to be dealt with in the operation of the steam turbine for ship propulsion, resulting in the impaired efficiency of the one or the other or both. This evil has been met in a great measure by new turbine arrangements, gearing and electrical reduction.

The main difference is that the torque or turning movement applied to the shaft in turbines is the direct energy of the steam acting on the periphery of the blade circle of the rotor instead of by means of the crank in reciprocating engines. The action is essentially the same as the steam expanding through a definite range of pressure and temperature expends the same energy whether it issues from a suitable orifice or expands against a receding piston.

The maximum amount of energy or work in foot-pounds that may be extracted through the turbine casing can only be obtained when the rotor diameter is so designed as to permit of the peripheral velocity of the blades being about half that of the steam, or put in other words the best bucket speed is at half the steam speed, under which conditions theoretically all the kinetic energy of the steam is absorbed. Steam at 150 pounds when expanded to atmospheric pressure attains a speed of 2950 feet per second, and if expanded into a vacuum of 28″ the velocity is 4010 feet per second, which would necessitate a bucket speed entirely beyond practical limits of construction; this high speed is reduced by compounding as will be shown later.

As with the reciprocating engine, power is obtained from heat; the transformation of heat into mechanical energy rotating the shaft, the expansion of steam in the turbine, however, more closely follows the adiabatic line, as no extreme variations of temperature take place as with the piston engine due to the condensation losses resulting from the alternately heating up and cooling of the cylinder walls. The turbine has the ability too, to handle large volume and consequently utilize low pressures which is a distinct advantage in its favour, this cannot be done with the piston engine, as this type of engine cannot be adapted to accommodate large volumes, and the mechanical difficulties presented by the undue size of low pressure cylinders preclude any advantage being realized with a vacuum higher than 26″. The turbine on the other hand gains rapidly in efficiency with every improvement in vacuum. It is estimated that an addition of 1″ over 26″ means a saving of 4% in steam consumption; another 1″ addition registered a further gain of 4½% while vacuum at 29″ brought the steam consumption down 5⅓% more. To further illustrate the benefits of this utilization of low pressures and high vacuum, let us take the case of the triple expansion engine with cylinder ratios H.P. to L.P. of say 1 to 7½. Assuming a cut off of ⅓ in the H.P. would give 22½ expansions by volumes. With the turbine, initial pressure 150 lbs. absolute and a vacuum of 29″ or back pressure of one pound we would get 150 expansion by pressures, from which it will be seen that much more work can be got out of the steam.

Reaction Turbine

There are many makes of turbines on the market today used for ship propulsion, but we need only deal with one or two of the principal types. The original turbine fitted in British warships was that designed by Sir Charles Parsons and worked upon what is known as the reaction principle; that is, the steam flowing axially or in parallel streams through the turbine expends its energy on the rotor blades, from where it passes on to fixed or guide blades and reacts again on to the next row of moving blades and so on to the condenser, the steam during this operation slowly falling in pressure and temperature and increasing in velocity and volume. It will be understood that a drop in pressure takes place in each blade row; therefore, with different pressures each side, the blading has to be constructed with minute clearances to prevent tip leakage, and all adjustments with regard to the expansion of the different metallic parts have to be carefully and finely made both with casing and rotor blades to reduce this loss to a minimum. Naturally, these clearances have to be adjusted for the highest speeds or highest temperatures of the various parts, if the speed is then reduced, the clearances are increased and the losses due to this increase rapidly and are said to vary as the square of the revolutions or a 3% loss at 600 revolutions would mean a 27% loss at 200 revolutions; it is therefore clearly evident that the reaction turbine is only economical at its designed speed.

To keep down the speed of a reaction turbine, when directly connected to the propeller shaft calls for a small pressure drop in each stage and consequently a large number of stages also the revolutions may be reduced by the increased diameter of the rotor; this, of course, means a much larger installation that small ships such as destroyers are able to accomodate.

Another feature of this class of turbine is that the expansion of the steam being practically adiabatic, the volume of steam increases steadily from its point of entry to the condenser; this increasing volume necessitates increasing blade heights and space. Theoretically, therefore, each succeeding blade should be longer than its predecessor; this of course, would add to the cost of construction, and in practice, it has been found sufficiently satisfactory to confine the rows of each separate expansion to the same height, and in the last stages instituting semi-wing and wing blading to allow for the large volumes. The reaction turbine, as stated earlier requires delicate adjustments and should be carefully warmed through before steaming.

It is the practice to fit what are known as cruising turbines with installations of the reaction type, in order that more economical running may be effected at low or cruising speeds. These turbines are distinctive from the ordinary reaction turbines in that they have longer rotor drums, owing to the greater number of rows per expansion and smaller blade heights. Their economy is due to their using a smaller quantity of steam at high pressure. Cruising turbines are not necessary with impulse turbine sets.

Impulse Turbine

The Curtis turbine is an impulse machine; its action being the conversion of the heat of the steam into kinetic energy, which when applied to the buckets of the rotor is transformed into rotary motion or work. This is brought about by the high velocity of the discharge of the steam, after being expanded in a nozzle. The impulse turbine may be described as a hardier machine than the reaction, the various stages being at constant pressure, fine bucket clearances are not necessary, then again the casing and blading are not subject to high temperatures, as the steam enters at a much reduced pressure and temperature after expansion in the nozzles. This type of turbine is not considered to be actually as economical as the reaction turbine, but it has many excellent features to recommend it, it being less susceptible to damage should water pass into the casing with the steam, and the absence of fine clearances allows of its starting up from cold much earlier. The power can also be increased or reduced by the addition or cutting out of nozzles.

The Brown-Curtis is another type of turbine much used in mechanical propulsion; it has a velocity stage similar to the Curtis, and a system of drum blading, similar in a manner to the Parsons' Reaction blading but so shaped as to form small steps of Impulse stages.

As explained the highest theoretical efficiency of a turbine is attained when the linear velocity of the moving blades is about half the velocity of the steam. As this figure is very high, there are two alternatives to obtain this result, the one to provide a revolution speed to meet these requirements, the other to increase the diameter in equal ratio to the reduction of rotative speed, which would mean increasing the size and weight of the turbine.

In impulse turbines when the throat pressure of the nozzle is .58 of the initial pressure, the limit of steam flow or velocity is reached and no matter how much the pressure is reduced, the quantity flowing through the blades of the turbine remains the same; on the other hand, if the throat pressure exceeds .58 of the initial pressure the quantity discharged is correspondingly checked.

A pressure drop results in increased velocity of steam in reaction blading, with constant pressure as in the Curtis and New Parsons, a decrease in velocity results.

Impulse turbines are compounded for pressure by increasing the number of nozzle stages, thus dividing the pressure drops into stages, impulse and reaction turbines are compounded for velocity by increasing the number of blade row stages or expansions. Impulse and reaction turbines may therefore be compounded for pressure or velocity or both. The necessity for compounding, it will be understood, is due to the difficulty of converting all the available heat energy of the steam into work in a single stage, and due to the exceedingly high blade velocity that would be required to absorb all this kinetic energy in a single row of blades of buckets.

So far, we have confined our remarks to turbines through which the steam flows axially. There is, however, another type which provides for a radial flow. The design has recently received much prominence for ship propulsion of small powers; it differs, as will be seen, from the others in the direction of flow. Its principle is on the lines of the reaction, and in place of the usual fixed or guide blades, the steam drives each alternate row in opposite directions. This turbine has given high results with the electric drive system for low powers.

The blading for high speed rotation due to the use of gearing has of necessity to be of heavier and stronger section to provide for high steam velocities and centrifugal stresses; the balance of material, however, is much in favour of the geared unit. A direct driven turbine with 70,000 feet of blading may be substituted by a geared turbine developing the same power with 7,000 feet only, taking the sections of blading and weights into consideration, however, the proportion is 8½ tons to 4 tons.

The saving in weight by the use of smaller high speed turbines is offset by the gearing, the difference being negligible, some little saving may be effected in boiler power and economy in fuel.

Before leaving the turbine, it may be remarked that many large passenger ships have adopted a system of combined reciprocating and turbine engines, great economy being effected by utilizing the steam at low pressures. Well known ships driven on this principle are the "Melita", "Minnedosa", "Olympic" and "Brittanic", the latter it will be remembered was one of the largest ships in the world and did duty as a hospital ship during the war. Her loss was due to an enemy torpedo. The usual arrangement provides for reciprocating engines driving the wing propellers exhausting into a low pressure turbine driving a centre shaft. The gain due to the utilization of the low pressure steam is shewn graphically on diagrams shewing the equivalent value of lower heat drop.

Boilers

Mention may now be made of the progress in boilers· this as will be seen has not been so marked as with engines. The square flue boilers of 100 years ago carrying 3 or 4 pounds pressure were improved somewhat year by year to carry higher pressures and in the year 1870 shew pressures as high as 30 pounds per square inch being carried. Great difficulties were met with to ensure the tightness of these rectangular boilers and considerable additional staying had to be fitted. In 1845, the Admiralty substituted the rectangular for the flue and in 1875 the oval boiler for the square and the pressure was raised in consequence to 60 lbs. Ten or fifteen years later, the cylindrical multitubular boiler commonly known as the "Scotch" boiler made its appearance; this type which is in more general use today afloat than any other. The cylindrical boiler is not, really speaking, an ideal means of converting the energy stored in the fuel to steam, but taking into consideration the many factors prevailing afloat there is much in favour of its continued use.

A comparison of the efficiencies of cylindrical and water tube boilers, apart from the saving in weight and space shews that the cylindrical is well to the fore.

Only pure distilled water should be used, as the cleaning of the internal surfaces of water tubes, if allowed to become coated with scale is a prodigious undertaking, also in the event of corrosion or wastage taking place, in the tubes, it is difficult to detect and more difficult to treat.

Cylindrical boilers are not so particular as to the purity of the water used; they do not call for cleaning so often, which means in a nutshell that this class of boiler will stand harder treatment, and is practically always available for use. These conditions count with the ship owner who, in many cases is obliged to run his ships at a stated schedule of sailing dates. The raising of steam may be a much slower operation, but this is rarely hardship; therefore, it may safely be assumed that the discarding of the cylindrical boiler is not yet, even though described by some authorities as being obsolete.

Liquid Fuel

The use of liquid fuel afloat dates back from 1902 and its extension to war and merchant ships from that date has been very rapid, all ships of His Majesty's fleet until very recently using oil fuel. The latest ships, however, are arranged to burn both coal and oil as a result of the recent scarcity in supplies.

It will be remembered that the well known ships "Aquitania" and "Olympic" were recently converted from coal to oil burning.

Advantages of oil fuel

(1) Greater evaporative efficiency in ratio of 15 to 10.
(2) No losses due to cleaning fires.
(3) No smoke or ashes.
(4) Better control of fires.
(5) Better facilities for ensuring good combustion.
(6) Smaller stokehold and staffs.
(7) Convenience of stowage and handling.
(8) Rapid and easy manner of taking in supplies.
(9) Greater steaming radius than coal.

Disadvantages

(1) Cost.
(2) Not obtainable as readily as coal.

Superheated Steam

It will be remembered that the use of superheated steam afloat is by no means a recent innovation; it was extensively used to combat cylinder condensation in marine engines, when working pressures were confined within the limits of five to forty lbs. With the advent of higher pressures, the difficulty of internal lubrication began which has been perhaps the greatest factor against its use during recent years.

The effect of superheating steam is to evaporate the particles of water contained in the steam or what is known as saturated steam, this results in the fluid being more into the nature of a perfect gas. The saving in condensation by its use is incontestable as is also its economy. The increase in temperature due to superheat has not been so much objected to as the dryness of the steam. Saturated steam with a certain amount of water in suspense is in itself a lubricant. With this moisture removed, piston engines required other means of lubrication and in cases of very high temperatures, these lubricants became burnt, which left all the internal cylindrical parts working dry and rapidly increasing wear and tear, both to the main engines and steam driven auxiliaries; then the question of the steam tightness of joints and valves had to be reckoned with. With turbines, these disabilities due to internal lubrication not being necessary are not experienced, the main objections to its use being the increased expansion of parts and interference with clearances due to the increased temperature; troubles have also been developed by the failure of the blading to stand the required stresses at these extreme temperatures, which trouble has now been met by the use of special copper and nickel blading.

Boiler mountings, pipes and valves require with high temperatures to be constructed of steel.

Another point regarding the use of superheat worthy of consideration, is the fact that dry steam does not quickly absorb heat; consequently a much greater heat must surround the tubes containing the steam than would otherwise be necessary say for water. The early superheaters were generally fitted in the funnels and absorbed heat from the waste gases. To follow out this practice today with the present high pressures and temperatures would mean a large increase of funnel temperature and subsequent loss of heat; therefore, the superheater of today must necessarily be placed near to the greatest heat, that is near the products of combustion; the latest practice with cylindrical boilers is to insert the heater tubes in the return tubes of the boilers.

Modern practice is in favour of the use of superheated steam especially with turbine installation, and ship owners are satisfied that the resultant economy outweighs the expenditure for special fittings and the original capital cost, as stated its economy is incontestable and in actual practice surpasses the theoretical benefits.

In actual practice, where the theoretical gain at 150 deg. superheat amounted to 3.8 per cent, the actual gain in efficiency registered 5½ per cent.

These results shew an improvement in turbine machinery efficiency by the use of superheat over dry saturated steam as 4¼% at 100 deg., 6¾% at 200 deg. and 7½% at 300 deg.

One distinct disadvantage of high ranges of superheat with turbine plants is the abnormal temperatures and stresses experienced by the astern turbine when bringing the rotor to rest for turning in the opposite direction special blading and material have to be provided to resist this action.

Michell Bearing

This paper would be incomplete if mention were not made of the new "Michell" bearing particularly as a thrust bearing; this development may be perhaps considered as one of, if not the most important additions to engineering science of recent years.

In ordinary reciprocating engine practice, the torque is not absolutely uniform and the thrust varies in a corresponding degree resulting in a slight pulsation in the load; this pulsation tends to favour the introduction of the lubricant between the rubbing surfaces. In arrangements of gearing there is an absolutely steady thrust, which checks the lubricant between the rings and collars. Trouble has always been experienced with the thrust bearing due to this cause being finally overcome by this new invention.

The principle of the "Michell" bearing is that of "pressure of oil film lubrication", that is to say, there is no actual metallic contact, the rubbing surfaces being entirely separated by a high pressure oil film, which oil film is generated automatically by the rotation of the shaft, no auxiliary pump being necessary.

There is no question that of all the bearings met with in mechanical propulsion by far the most important is what is known as the thrust bearing, as against this the whole force moving the ship must press. The ordinary thrust shaft is of the multi-collar type, the number of collars necessary being calculated from the foot lbs. of thrust and an area sufficient to take the whole weight at an average pressure of about 50 lbs. per square inch must be provided. In this design of bearing the friction is proportional to the thrust, consequently when the thrust increases say due to bad weather, the friction and temperature increases. The effect of this friction and increased temperature causes unequal expansion which results in further friction and in the end the usual hot bearing. In the "Michell" thrust bearing, not only is the friction independent of the thrust, but having only one collar no expansion troubles occur.

A comparison of the old and new type of shafts are herewith shewn, which impresses one immediately with the simplicity of the one collar shaft required for the Michell bearing. The general practice with the old type was to arrange for the force of the thrust to be taken on horse-shoe adjustable bearings at each collar. In the Michell block the pressure is taken up by a set of loose pads 5, 6, 7 or 8 as the case warrants; these pads fit into panels of a containing frame ring or cage which forms the block. The pads are segmental in shape and are so adjusted to allow of a slight rock or "wabble" by being pivoted at or near their centre; the effect of this slight lateral motion is to allow a liberal oil film clearance between the bearing surfaces of the block when in motion. A steel button with a hard rounded point is fitted on which the pads cant over when acted upon by the thrust pressure and oil service.

As the shaft collar revolves, the oil is forced up continuously to the surface of the pads with the result that the pads will comfortably take a pressure per square inch of about 10 times that of the old type bearing, that is to say 500 lbs. per square inch instead of 50 lbs. per square inch. The pads are of gun metal with white metal surfaces.

One essential condition for the maintenance of a pressure oil film between two lubricated surfaces is that the surfaces must have a slight inclination to each other, so that the opening at which the oil enters is greater than that at which it leaves the brass.

The thickness of the oil film is very small, being sometimes less than $\frac{1}{1000}$ of an inch.

A bearing of this type, which we may describe as being tested to destruction shewed that it ran cool under a pressure of 5 tons per square inch, at which pressure the white metal surfaces failed and began to squeeze out like butter.

Perhaps what may not be considered of great importance ashore, but which is afloat, is the question of space, the limitations aboard ship for machinery room is very restricted, especially in ships of war. It is here that further advantage is derived from the Mitchell bearing. A recently designed machinery arrangement by the adoption of the Michell bearing made a saving of 5 feet in length out of a total length of 25 feet.

Internal Combustion Engine

Many advocates today favour the internal combustion engine as the prime mover in ship propulsion for moderately powered cargo and passenger ships and it is unquestionably a live competitor for ships of this class. The usual type favoured is what is known as the Diesel engine, named after Rudolph Diesel, who effected a patent on his engine in 1893.

The action of this type of engine is essentially, as its name implies, combustion of the fuel in the cylinder; this is brought about by the injection of a spray of fuel into the cylinder carefully timed under high pressure, the high temperature in the cylinder providing for the gassification of the liquid and the compression for its ignition, the rate at which the fuel is injected being so arranged, timed and adjusted that the combustion takes place without any explosive violence and with substantially no change in pressure. The air temperature varies at about 1000 deg. F. at the usual pressure of about 450 to 500 lbs.

This type of engine is still in the experimental stage, although good satisfaction has already been given by the different types in use.

Many difficulties are yet to be overcome in the development of this engine for large powers. So far, cylinders up to 30″ in diameter have been used with satisfactory results; as the diameter increases the problem of suitable castings and materials become more complicated as the high pressures and temperatures which result in heavy stresses and variations of expansion.

The factors opposing the progress to high powers are the temperature gradient through the metal in the combustion chamber and the fact that the major portion of the material of the engine is utilized for a small fraction of the running time only; the former refers more particularly to the two cycle engine and the latter to the four cycle engine where three-quarters of the running time is idle.

To emphasize the abnormal stresses to which the Diesel engine are subject, comparison may be made with a steam engine of normal design and equal power. It is calculated that the maximum normal load with the oil engine is more than five times as great as with the steam engine; further, the rate of application of this load is ten times greater. It will therefore be seen that with these abnormal stresses liable to sudden increases, a larger factor of safety in design is necessary to ensure good and reliable operation.

Accurate data is not available as to the temperature gradient and subsequent stresses, but so far as it is known, it is considered that the temperature gradient of a four cycle cylinder liner varies very little from that through the furnace of a cylindrical marine boiler; in the former, the stresses are live or intermittent and in the latter relatively steady. Further, the material in the former is cast iron and the latter steel with a much higher coefficient of expansion and greater elasticity.

Comparing the Diesel with the steam engine, the former may be described as having a more violent action; it is more costly to construct and requires more expert care in handling. Recently great strides have been made in its development and reliability, and its management has been more generally known; this has been verified by the recent decision of underwriters. To accept risks on Diesel engined ships at the same rates as steam driven ships, which doubtless resulted from good performances shown, as an example the "Selandia" built in 1912, and fitted with the famous four cycle engines of Burmeister and Wain, which has been in continuous operation now for eight years. Up to 1920, nearly 60 vessels have been installed with engines of this company aggregating over 170,000 Horse Power.

The ordinary Diesel has not been eminently suitable for moderate powers in ships, that is to say, the revolutions and power obtained do not permit of suitable propeller revolutions for moderate speed single screw ships, and so far twin sets have been adopted to overcome this difficulty. The new type of opposed piston engine already mentioned meets these requirements, developing economical revolutions both for engines and screw, a considerable saving is effected with the initial cost thereby.

As explained, the Diesel engine cannot produce very high powers and therefore is unsuitable for fighting ships — with the possible exception of submarines — possibly the disabilities in the way of high powers may be overcome in the future, or who knows, we may wake up one fine morning to welcome the internal combustion turbine.

The great advantage of the Diesel engine as already explained, is its high thermal efficiency as compared with other types, which is directly attributable to its comparatively low consumption. The oil consumption is .45 per B.H.P. per hour as compared with 1.25 lbs. per I.H.P. in the steam engine.

The actual distribution of heat for a Diesel engine is approximately:

Thermal efficiency	39%
Heat loss in exhaust gases	35%
" " water cooling	20%
" " due to radiator	6%
	100%

Comparing the internal combustion engine with the steam engine shews the great economy of the former.

Type	*value of fuel*	*consumption*	*thermal efficiency*
Steam engine	14,500 B.T.Us	1.25 lb.	3 to 10%
Paraffin engine	21,500 "	.8 "	15 to 20%
Petrel engine	22,000 "	.6 "	18 to 25%
Diesel engine	18,500 "	.44 "	36 to 45%

Electric Drive

We now come to the final and last stage of engineering progress in the propulsion of ships that has marked the last 100 years as the era of the engineer. This last innovation is the electrical propulsion of ships, or as it is familiarly described, "The Electric Drive".

The United States collier Jupiter was built in 1912 and fitted with the electrical system of propulsion; at the same time a sister ship was built and installed with reciprocating engines; the ships were to all intents similar in build and dimensions and comparative trials were taken; these trials shewed at full speed a steam consumption per shaft horse power hour of 14.0 lbs. to 11.1 in favour of the Jupiter, and this with a weight of machinery of 156 tons as compared with 280 tons for the reciprocating engine driven ship.

The outfit of the "Jupiter" consists of one turbo generating unit furnishing electricity to two induction motors each coupled directly to one of the two propeller shafts.

The satisfactory performance of the "Jupiter" so impressed the powers at Washington that the battleship "New Mexico" was proceeded with on this new arrangement of power.

The propelling machinery of the "New Mexico" called for 28,000 S.H.P. She was designed, however to produce a maximum of 37,000 S.H.P., which it was calculated would give her a speed of 22 knots. The equipment consists of 2 turbo generating units driving 4 motors directly connected to four shafts; by the use of one generator only, it is claimed a speed of 19 knots could be obtained; the propeller speed at 21 knots was limited to 175 revolutions thereby providing a speed for efficient propeller design.

The design of motor differed from that installed in the "Jupiter" as the requirements were dissimilar, the "Jupiter's" duties not calling for the high power and variable speed necessities of the "New Mexico"; therefore she was installed with induction motors of the slip ring type designed for operation with a winding that permitted only of one relative speed reduction between the generator and motor. The "New Mexico's" motors are adapted for high power battleship drive, at full power, medium speed for cruising and quick reversal powers at all speeds. To obtain these conditions the changeable pole motor was developed, the motors having pole changing ratios of 3 to 2. The windings of these motors, which are quarter phase or two phase, have coils so arranged that a change of terminals will give a balanced distribution of either 24 or 36 poles. As all four motors receive power from both generators at full power and from one at low power, the best combined operation is with decreased voltage on 36 pole operation. 36 pole for cruising speeds.

Trials taken shewed that starting resistance would only be required for a very short time during starting and reversing to exert a maximum torque on the propeller to bring it up to its required speed rapidly. The motors therefore, for this purpose were constructed with two squirrel cage windings, the outer high resistance on starting and reversing the inner low resistance winding when up to speed.

This design was adopted on the principle that the peak load which the motors can carry is determined by the generator and not by the motors. In addition the special requirements for reversal had to be met by combined characteristics of both generator and motor, or in a few words, the essence of the arrangement is the field excitation of the generator. The amount of field excitation that can be applied continuously determines the continuous performance at full speed, and the excitation that can be given momentarily determines the momentary overload and reversing performance, therefore the control equipment arranged for the "New Mexico" is a departure from the usual practice in that the whole process of manoeuvring has been planned around the idea of adapting the motors to their different functions by the manipulation of generator field excitation.

The power that can be drawn from a turbo generator of any given size is limited by its drop in voltage and for reasons of economy it is generally designed to be operated at its maximum output; therefore, it will be seen that it is not possible to draw any increase power from the generator unless the field strength is increased simultaneously. It is calculated that the maximum power that may be drawn from a generator varies substantially as the square of the field current and consequently, heating is indirectly the limitation of its continuous output, the momentary output, however, may be greatly increased by the momentary increase of field current.

Propeller trials taken with the "New Mexico" shewed that with no driving power applied to the propeller, it continues to rotate at full speed by the action of the water upon it at a speed of 73 per cent, which called for a breaking torque practically equal to full power to bring it to rest, and for quick reversal requirements a considerable driving torque in addition to spin the propeller in the reverse direction; these conditions, it will be seen, can only be obtainable by momentary high powers due to high ranges of field excitation.

The main generators are two pole two phase having a full load capacity of 10,500 kilowatts at 78% power factor with a 25% overload capacity, speed 2,100 R.P.M., 35 cycles.

The generators are similar to those of land installations except that provision is made in the design for 50% excitation or big overload capacity, in order that the voltage may be maintained under heavy overload or, in other words, a greater overload capacity than usually allowed.

This is necessary to provide heavy starting and reversing currents called for in ship manoeuvring.

Motors are of the squirrel cage induction type, each rotor being provided with two separate squirrel cage windings, the one of high resistance to give the necessary high starting torque and the other of low resistance for efficient running at operating speeds.

The speed variations are obtained on these motors by means of pole changing connections whereby the stator windings can be connected to either 24 or 36 poles, thus providing two alternative speeds in the ratio of 3 to 2.

The generators are driven by two duplicate Curtis impulse turbines directly connected to the generators.

The motors for the new high power battle cruisers are similar in design to the "New Mexico's" except that they are 3 phase with change pole ratios of 2 to 1 instead of 3 to 2.

Commander Robinson of the United States Navy, who has been in charge of the experiments and trials of the electrical transmission in the "New Mexico" is emphatic as to its reliability under all conditions and claims that when compared with systems of turbines with reduction gearing considerable economies are shewn.

So far, the only advantage in favour of the electric drive over its rival has been at cruising speeds by an appreciable saving in fuel.

There are several phases in connection with the electric drive, which shew to considerable advantage over the other. The great drawback with turbine engines afloat is that in order to drive the ship astern separate turbines have to be added or incorporated in the ahead casings; this, apart from the initial cost of construction and space taken up proves a serious loss due to wastage of heat and what is known as windage by the turbine revolving idly when the ahead turbines are in use. Again, the astern turbines are not adjusted with fine clearances so necessary to those of ahead operation and are never of dimensions sufficient to permit of astern power beyond 50% to 60%, whereas full power may be obtained with the electric drive in about 20 seconds.

We have spoken of the drawbacks that are met with by the use of superheat; these are practically non-existent with electrical transmission, that is to say, high speed turbines operating in one direction only can accommodate high degrees of superheat with perfect safety, resulting in great economy. In fact, there are no mechanical systems of propulsion so suitable as the electric drive for adopting superheats and the advantage over the geared arrangement in this particular is very marked, no disadvantage being felt with auxiliaries as these are electrically driven.

Taking into consideration all features of the two types we have just had under review and the requirements specially called for in high powered ships of war, it would appear that the new line followed by the Naval Board of the United States of America in discarding the geared system of mechanical propulsion in favour of that of electrical transmission has been fully justified.

How and Why Production Methods Increase Shop Production

A general outline of modern production methods, with particular emphasis on the importance of the shop schedule.

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The principal purpose of this paper is to throw some light on the present status of a subject, which for the past ten years or so has been buffeted and jostled along, progressively nevertheless, under such headings as Scientific Management, Production Management, Efficiency Engineering and so on, and to show that now all the shine and sparkle of the original schemes offered has somewhat worn off, that there has evolved from it all, a real and definite line of action which is of sound engineering principle and application. To be real and sound of engineering principle it must be practical and give the results it is designed to give.

It is not intended to go into the question of the merits of one particular system as compared to another, because the final analysis of all the systems that have survived the past ten year period of evolution, would only prove that the basic principles of them all are extremely alike. In passing however, it should be stated that the author's experience has been based largely on the application of the methods advocated by the late H. L. Gantt, whose authoritive work on the subject has been recognized the world over.

When an engineer undertakes to design a structure or machine, he first of all gets a clear definition of what the purpose of the structure is. Then he starts his design, analysing every detail part to be sure that it will perform its required function, yet be neither too heavy, nor yet too light, so that the finished product is a harmoniously working machine, evenly balanced all over, that fulfils the contractors original requirements.

The problem of managing a factory is an engineering problem which is identical with any other engineering undertaking, and if the plant management machine is such that each unit of its structure fulfils the function it is designed for, not overloaded, not too light for the job, and without slack motion or unnecessary units to make it cumbersome, it will produce the best possible result.

The preliminary analysis of a management problem, however, reveals an element that is not met with in the same degree in material designs, namely the *human* element, and we must realize at once, that it is this human element, that has individuality, and personal power to perform according to capability and training the functions laid down as desired, that constitutes the problem of production.

Let us pass from generalities on the subject and put ourselves for the moment in the position of a factory manager whose object is to deliver his output, made right, at the lowest cost and at the promised time to his customers. This briefly is or should be every manager's objective, but let us suppose that he is confronted with the fact that he is losing business because his competitors can undersell him. What does he do?

Surveying the situation he realizes immediately that he must reduce his manufacturing cost on that article, for the close out the manufacture of that line would only add to the overhead expense to be added in the balance of his products, and thus render them more expensive to produce. By this method he would surely end by putting himself out of business altogether.

This manager will then probably call a conference of his shop executives, either individually or collectively, and maybe show them the cost records, and he will end most likely by a general admonition of some sort, which is later transmitted right down to the men, in the nature of a threat that they will all lose their jobs if they do not increase their output to reduce the costs. In other words, he sets out to hustle the shops along. He may further go around the shops daily and inquire about delays and take a more personal interest in the progress of all the work. In fact, he most probably will work tremendously to get things right, yet never realize that most of his effort is lost because all his data and information is history before he starts to work on it. By his vigorous digging into things he finds perhaps, delays in getting material from one shop to another, delays in getting the job started. He may find too large a percentage of rejections. He may find the reason for these lack of proper jigs or tools and a multitude of other reasons that are available for advancement — *but they all occur before he finds it out.*

This same manager will go to his cost records and probably find that no figures are available until weeks after the job is done — and if he questions closely he may find that all the accuracy in the accounting system is in the office, and the service records of the men's time or materials used, are subjects of considerable uncertainty. The facts remain, that this plant exists on its ability to make a profit and yet the accounting system is such that it *provides only history for the shop supervision* to be guided by. The reason for this it will probably be found is that the accounting system is being run by an office accountant, who, while satisfying the financial requirements of the company, does not realize or know the shop requirements, and that to advise a foreman a certain job lot order cost ten per cent more than the last lot, does not do *that* job any good. A foreman wants to know what operation is costing more than it should, right while he has the job, when he can do something, not when it is done and gone.

Following up this line of thought, this manager may well ask such questions as: "How do I know that my machines are producing what they should? How do I know that the men running the machines are as good as my foreman says? How do I know that the delays due to machine repairs are not too high? How do I know whether it pays to operate some machines at all? Who is responsible for the supply of proper jigs or tools? Who is responsible for getting all the units of a lot together before work is started? How is inspection carried out? Does raw material go into shop from stores promptly and on time? Who sees that each operator is properly instructed before starting a job? How do I really know when any job will be finished?" — and many other questions might be asked.

His answer would probably be "This is what I pay my foreman to do, and for the past twenty years it has worked all right, so why should I change now?" The answer is, that others have changed and reduced their costs to a point, where you must change or be put out of business.

The principle under modern methods is that specializing pays in management, just as it pays to develop machinery to do special work when there is enough of it, and it likely has not occurred to this manager that he is expecting more, than it is possible to get from his supervisor under present competitive conditions.

Now our manager has heard about these production methods in a hearsay manner, and while not in sympathy at all with them, he rather feels that nothing is lost anyway by actually investigating a little on his own. We will assume that he decides to visit the plant of a friend manager, of his, who uses these talked of methods and that his friend is trying to give him all the information possible. One of the first questions he is likely to ask is: — "Is there any vital difference in your plant organization now, as compared with previous period?"

There is, in that a new department, which we call the Planning Department, was inaugurated. This department acts as a sort of clearing house for all departments, and performs many functions that the foreman was previously called upon to do. It is divided into specialist divisions itself, having a scheduling or routing section, a material tracing section, an estimating section and a cost division, with which is incorporated the bonus or piecework system of the plant. It is to be understood, of course that the size and nature of any plant determines whether more than one of the above divisions can be represented by one man or more, the point at issue merely is to show that the items are treated separately.

To explain how these functionaries operate let us follow the course of an order from the beginning. Let us say the order is for a standard machine which we are to manufacture.

The first step is the getting out of an accurate bill of material which the Engineering Department make up from their drawings. Since this order is for a standard make of machine, this bill of material will be available immediately, and one copy of it is marked up as quickly as possible by the Storekeeper to show whether each item is "Purchased finished" whether it is "In Stock" rough or finished or whether it was to be "Manufactured". We will first follow up items that we have to manufacture.

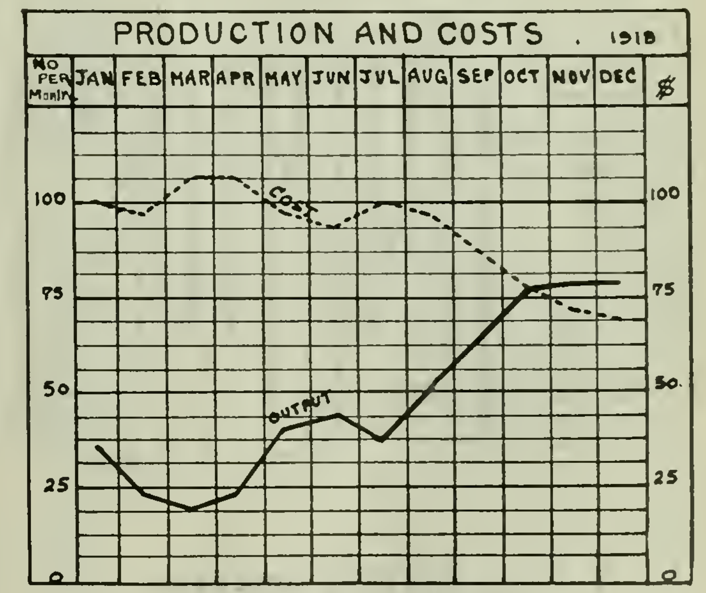


FIG 1 WHAT HAS HAPPENED

Actual result of production methods applied.

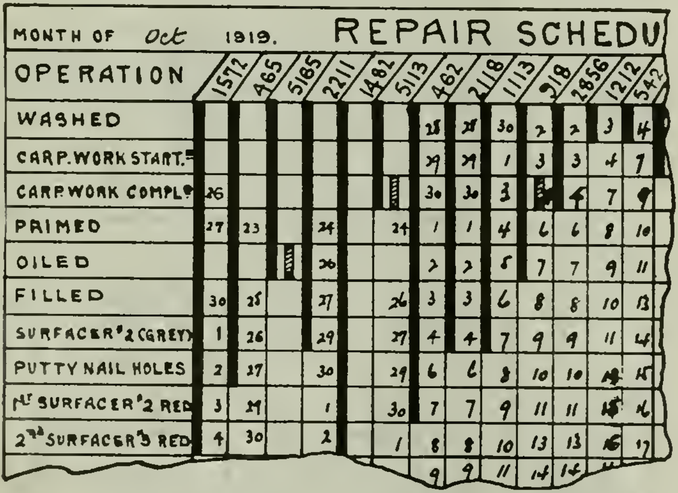
When the bid was made to get this order, we promised delivery at a certain date. One of the most important functions of the Planning Department is to see that delivery is made on the promised date. Consequently on receipt of the order, a plan or schedule is made detailing all the various operations and parts for the complete order and giving a date when each item must be completed in order that the final assembly be made in time to ship on promised date.

In making up a detail schedule for any job it may be repeated that the important date is the date promised the customer for delivery. Consequently that one point being set, all others take a certain relation from it. This is the way it is reasoned. In order to deliver by March first, this machine must be tested by February 26th to allow for shipping, etc. Erection of machine must be finished by February 24th, allowing two days for test, and adjustment. Ten days are required for erection therefore all parts must be on erecting floor by February 11th, Sundays and holidays must be omitted in these computations, of course.

We now arrive at a date when all the detail parts that go to make up the machine must be complete. All machining operations must be finished and inspected and all other material such as valves and details that are "Purchased finished" should be in stores at this date.

In order to make sure that they *are* ready, we list up every item on Bill of Material on a schedule or planning sheet classifying them usually in order of size and importance. All the dates as found by foregoing reasoning are entered on this sheet, and the process of working backward from each date is continued on every item.

Taking the large items first, we list up all the operations that have to be performed on it and the time each operation will take. This time is taken either from previous records, the time allowance for the job if a priced operation, or else if neither is available an estimate is made. Placed end on end graphically, we arrive at the latest date when material must be in the shop. If it is cast iron this constitutes a delivery date for the foundry. If wrought iron a delivery date from the forge shop and so on each item is covered. It will be seen that as each item is traced back to its origin we obtain definite points upon which to work to ensure final delivery on promised date.


MONTH OF Oct 1919. REPAIR SCHEDU

OPERATION	1572	465	5165	2211	1482	5113	462	2118	1113	918	2856	1212	542
WASHED							25	27	30	2	2	3	4
CARP. WORK START.D							29	29	1	3	3	4	7
CARP. WORK COMPL.D	26						30	30	3	[illegible]	4	7	9
PRIMED	27	23		24		24	1	1	4	6	6	8	10
OILED				26			2	2	5	7	7	9	11
FILLED	30	25		27		26	3	3	6	8	8	10	13
SURFACER 2 (GREY)	1	26		29		27	4	4	7	9	9	11	14
PUTTY NAIL HOLES	2	27		30		29	6	6	8	10	10	14	15
1st SURFACER 2 RED	3	29		1		30	7	7	9	11	11	15	16
2nd SURFACER 3 RED	4	30		2		1	8	8	10	13	13	16	17
							9	9	11	14	14		

FIG 2 MASTER SCHEDULE

Applied to shop repairing locomotives.

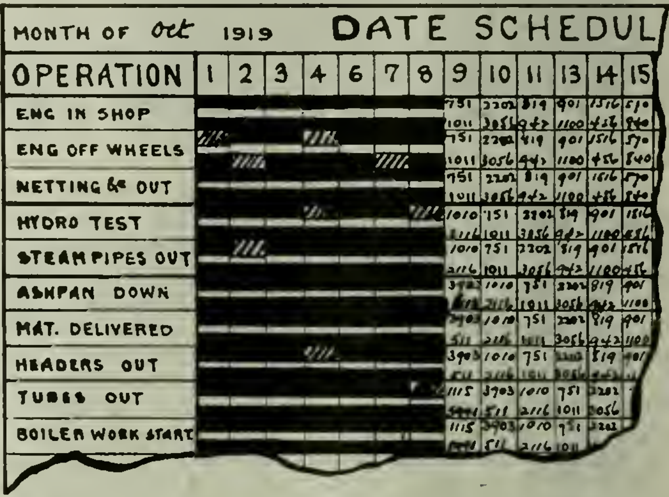


FIG 3 DATE SCHEDULE

Shows a rearranged master schedule to locate all operations due each day.

By this same process we arrive at the date when blacksmith must start his work, which is the date raw material must be available. This also gives us in case of cast material, the date pattern makers must be finished and finally the date that drawings and all information must be available from Engineering Department or Draughting Office. It is just as important to have the Draughting Department information on time as it is to have the first mentioned operations "on time", because when a job starts late, the tendency is to stay late and the catching up process is always most expensive.

When this Master Schedule, as it might be called, is made, allowances between each operation for inspection, moving, etc. are included. When finished we copy it on smaller sheets, grouping all the work for each department. For instance, there is a foundry schedule, a machine shop schedule, a material schedule, etc. These are of convenient size so that the checker from the Production Department can carry it around as he goes from department to department. Each department head is given a copy of the part that concerns him so that he is thoroughly posted on the requirements from his shop.

The method of handling these detail operation dates with the foremen always depends on the shop itself. In one shop where the detail was very great all operations were put on cards and placed in a despatch board which contained a pocket for each machine. Cards were arranged by Production Department with "next job" in front and others in order so that departmental foreman was able to get tools and material up to man before each current operation was finished. The card in this case was the job card for the bonus system and was placed in a pocket at the machine, when job started. When job was finished it was passed to inspector who checked work, before payment for same was made.

Another way is to make up a list of operations to be done to-morrow for each foreman from the schedule. This list is given the foreman the evening previous and checked with him the following afternoon to ascertain reasons for failures to perform any time scheduled.

Whatever the method, the reasons for failure to make the scheduled dates are recorded and taken up with the department concerned. For instance, (the writer quotes from actual experiences,) we found boilermakers failed to deliver required output on account of insufficient air pressure. The matter was investigated and found to be a real source of loss and changes in air lines resulted. We found men who could not do the work in time specified, who were poor men and instruction failing we moved them onto some other work that they could do. We found that certain machines would not stand up to speeds asked and so they were taken out of regular service. We found other men who failed to deliver the required output per day on account of the small quantities he had to make on each order. This was remedied by placing orders for larger quantities. We found milling operations held up for special high, speed cutters when the high speed steel price was so high, and found that the best policy was to make carbon steel cutters. We found cases when high speed steel drills should have been used also cases where carbon steel drills should be used instead of high speed. This latter case was inexperienced men drilling small holes.

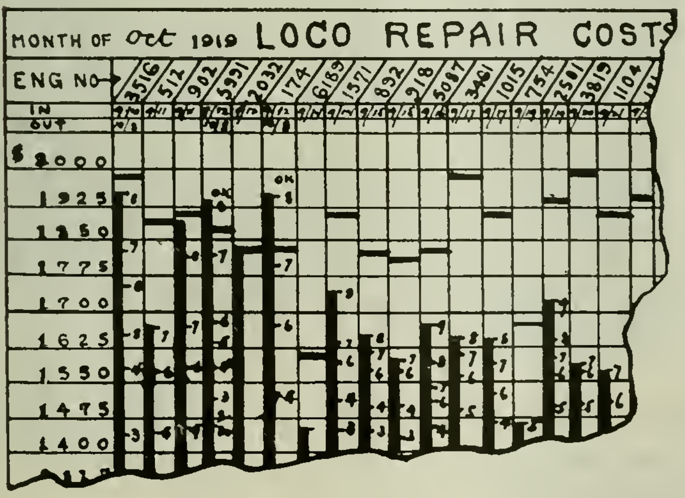


FIG 4 LOCO REPAIR COSTS.

Shows graphically expenditures to date for comparison with progress indicated by master schedule.

These delay experiences could be mentioned indefinitely and are to be found in every shop. The man that says these things do not occur in his shop merely deludes himself and his company pays accordingly. The principle however, is to notify the foreman concerned first so that he can get after the delay and then by recording same on daily delay sheet which is a summary of all late items, the general departmental heads are informed of all progress, and can lend their assistance to the prevention of repeated delays.

Now with regard to stores stock items and purchased finished items, it is usually not sufficient to rely on them being available when required without making some check. The Storekeeper has maximum and minimum stock amounts to carry, and unless provision is made there is nothing to prevent his being at or below the minimum just when you call for any item. Therefore it is necessary that a reserve system of some kind be adopted. Some companies actually draw out of the store and place in a bonded store what is required for each order, while others simply mark the bin tag that so many are reserved for order No. so and so and that is sufficient, as the Storekeeper records on the base that that stock is issued. All items not actually in sight are traced a sufficient time ahead of requirement so that the possibility of delay from this source is reduced to a minimum.

So far we have told how we relieve the foremen of some duties that used to be theirs by planning their days work for them and by hustling the material along to them and notifying him and all concerned of delays. Briefly, we show how we check up stores stock to avoid being "left" when assembly is due to start. A few words as to how this information is recorded will be in order, because it all sounds complicated, when it is in reality a simply process.

On the schedule sheets mentioned one line is left for each item. The top of the sheet horizontally is marked dates in case of shop schedules and represents 100% in case of material check sheets. As each check is made a horizontal line is extended from the left to the column representing date of check. This line by its color indicates the exact standing of that item. Five colors only are used, black to indicate "finished", red to indicate "Material Trouble" of any kind, green to show delay is up to shops, yellow to show "Engineering Department information" causing delay and blue indicates ahead of schedule. Each day each black line is extended to correspond with amount done and all other spaces up to date are colored to show reason for delay.

On the shop schedule sheets the same method is employed and the same color scheme used to record progress. In this way a summary of detentions is always possible. This avoids shops getting all credit for delays which are most often not up to them. It also shows the management, where the weak places are and generally point to the obvious remedy.

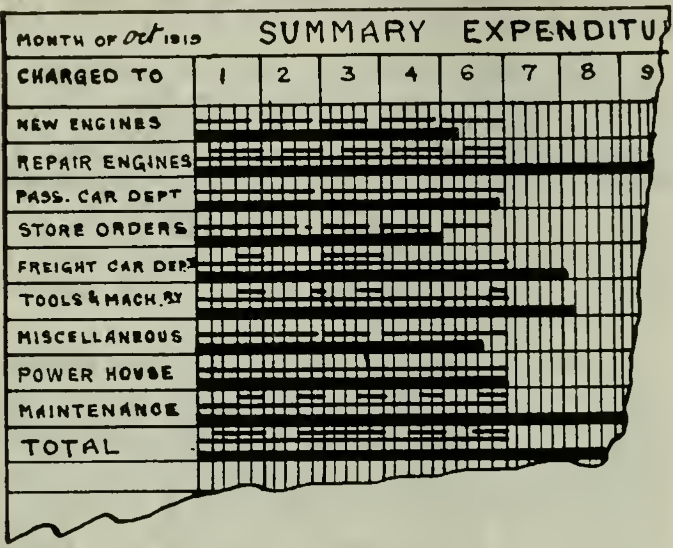


FIG 5 SUMMARY & EXPENDITURE

Shows a graphic method of knowing how expenditures check with estimates on allowances by periods.

Now with regard to costs. It may be considered with all the check on the shop that these should take care of themselves, but not so. In obtaining our order we quoted a definite price which means we have estimated a definite cost. It is our interest to see that the operators perform each operation in the time estimated, or as close as possible, and to that end we see that the shop supervision in charge of the operations, is posted as soon as an overexpenditure is in sight. In a piecework shop this is a comparatively simple matter because the job card shows the time allowed for each operation and the man checking the output can tell each time he visits the operator whether he will complete the job inside the allowed time or not. In a daywork shop, it is necessary for the previous day's time to be extended immediately and placed alongside of the estimated allowance for that shop job or operation. The supervisor can then tell quickly how the cost stands, and if necessary do something to obtain better machine efficiency, before the job leaves the shop when his last chance is gone. The estimating is done by specialists who have the benefit of the foremen's experience when required, and the checking and extending of time records is done by men who can point out to the supervisor the danger as they show up.

One of the most noticeable effects in a shop not previously scheduled will be that most of the delays recorded will be found to be up to the management and not up to the operator. The time between operations is found to be excessive and even unreasonable when analysed in detail. These being previously a function of the management, action can be taken that keeps the work moving forward as soon as ready. The fact that the work is close up to the operator all the time, has a stimulus far better than any hustling on the part of foremen, for when an operator can get right on to his job and does not have to want for this tool or that drawing or instructions, he is not only more contented but he does better and more work. All this is outside of any premium or piecework system that may be employed to provide an incentive for him to work harder.

As this argument has been followed through, it will be realized that the essential difference being the old method, and that of the shop with production methods is, that every man has a definite task ahead of him as a day's work. Our manager realizes that the success of the latter is because every operation is carefully planned, and that there is exact information as to conditions on everything, he sees that passing responsibility is difficult with such a system, with the result that instead of endeavouring to do so, each man and supervisor gets down to his job instead. He also realizes that instead of asking the various shop supervisors "how things are" in the planned output shop the boss asks definitely why such things happened. In other words he knows the weakness and is there to add his experience to prevent a re-occurrence.

In conclusion, while the writer realizes that the foregoing presentation of this subject has only touched the high spots, it should be said that this is purposely so. The practical manager will agree that the principles and purposes outlined are simply common sense and that there is nothing really new about any of them. The difference is in the application and use made of them. Once it is realized that the functions of managing a plant are capable of detail analysis and design, then the functions to be performed by each part of the management machine can be regulated to perform that function, as accurately as for any engineering structure, and when it fails, the engineer in charge knows where and why. He knows these things when they occur, not when the final cost sheets show him he has lost money.

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Classification and Remuneration

At the meeting of Council held on June twenty-first the report of the Committee on Classification and Remuneration of Engineers, covering its work relating to salaries, was presented and considered. In a letter of transmittal the chairman, A. H. Harkness, M.E.I.C., suggested that the report of the Halifax Branch Committee on Classification and Remuneration should receive very careful consideration before any action be taken by Council on the report of the committee of *The Institute.* The report submitted follows the line of the previous suggestion as to classifications similar to that of Engineering Council report. In view of the suggestion of the chairman, it was decided that the committee on Classification and Remuneration should consider the Halifax Branch report and make its recommendations to Council at an early date.

The report of the Halifax Branch on Classification and Remuneration is as follows:—

"Since its appointment, your Committee has held a number of sessions. In addition, a considerable amount of individual work has been done by the members of the Committee.

We may say at once that, though considerable progress has been made, your Committee is not prepared to submit a schedule of classifications and remuneration, for the reasons herein set forth under the head of "Findings".

Furthermore, your Committee for the same reasons, do not consider it in the best interests of the Branch that we should submit such a schedule.

We suggest that, if it meets with the approval of the members, the objects sought can best be promoted by the official endorsement of our "findings" by the Branch, and the forwarding of the same to the Central Executive at Montreal for their consideration.

Findings

An examination of the various reports on Classification and Remuneration of Engineers, as submitted by various Branches in Canada, and Engineering Associations in the United States, suggests the following criticisms by this Committee:

(a) Although in each case, much time and effort has been spent on their preparation, few of the reports are comparable, particularly as to classification.

(b) Most of the reports appear to have been prepared specially to fit local conditions and classifications, rather than to standards applicable throughout the country.

(c) Little attention appears to have been paid, in most cases, to any classification as to the size or responsibility of a position, resulting in undesirable vagueness in this respect. For example, a classification of chief engineer of a railway is set up, with an attached salary. It must be obvious to everyone that the railway systems are of all sizes, and the responsibilities and salary of chief engineers should vary accordingly.

(d) Many engineers are engaged in positions which, while calling for technical knowledge, are also largely of an executive or administrative nature. This phase does not seem to have been sufficiently recognized in many of the reports.

(e) Smaller firms find it necessary to combine under one man, duties, which in a larger concern, are performed by several engineers, each specializing in one branch, and the ability and knowledge required to fill such a position satisfactorily do not appear to have been recognized.

(f) Experience and technical training are, in most cases, stated as the qualifications for any specified position, whereas it is generally known that good judgment, supervising ability and similar requirements are equally essential.

Considering the above criticisms of existing reports, your Committee feel that the question can only be satisfactorily and authoritatively settled, by dealing with the question in a broader and more comprehensive form than has hitherto been attempted in any report that has come to our attention and we therefore submit the following:

Recommendations

We believe that any schedule to be prepared, should be Dominion wide in its application, and that its preparation will necessitate the appointment, by the Central Executive, of a standing Committee, prepared to devote considerable time to the question, aided by a paid secretary who would devote his entire time to the collection, preparation and tabulation of the necessary data.

Should the present funds of **The Institute** not warrant the appointment of such a secretary, we suggest that the expense be met by a special levy of $1.00 on each member.

It appears that the necessary preliminary steps should include the gathering and compilation of the following data:

(a) From each member of **The Institute of Canada**, and from all members of Associations of Professional Engineers, his own classification, salary, position in the organization of his firm, and its magnitude.

(b) From all firms employing engineers, their organization charts, showing all positions filled, or requiring to be filled by professional engineers or those training as such.

From the above a complete classification can be prepared, and a tabulation of present remuneration, forming a working basis for the Committee's deliberations.

As the magnitude of a position plays an even larger part in a scheme of fair remuneration than does its classification, it will be necessary to prepare standards in this respect, at least as general guides.

While this is a difficult problem to solve, your Committee consider it feasible, just as at present consulting engineers, architects, etc., are able to set their fees as a percentage of the cost of work to be undertaken.

The following suggestions indicate some possible classifications in this respect:

(a) Municipal engineers: based on population served.
(b) Street Railway and Steam Railway: based on track mileage and population served.
(c) Construction and Contracting firms: based on class and volume of average contracts handled annually.
(d) Industrial firms: based on annual production.
(e) Telegraph: based on line mileage.
(f) Telephone: based on number of substations.
(g) Electric lighting and Power companies: based on installed capacity.

Some considerations in setting salary schedules covering the entire Dominion, should also be given to location; as climatic conditions, living conditions, nature and permanency of employment in different sections and positions, all have their application in the matter of fair remuneration.

Respectfully submitted: (*Signed*) F. R. Faulkner, *Convenor*, F. W. W. Doane, A. F. Dyer, I. P. Macnab, W. A. Winfield.

Leonard Medal Rules

The rules governing the award of the Leonard medal, at the suggestion of the donor, were changed at the meeting of Council held on the twenty-first instant, the former rules required that one member of the committee be the donor or his nominee. This has been amended whereby the entire committee shall be appointed by the Council of *The Engineering Institute of Canada.*

Unique Anniversary

The hundredth and fiftieth anniversary of the Smeatonian Society of Civil Engineers was celebrated by a dinner in London on January twenty-sixth. Past-president Lt.-Col. R. W. Leonard, M.E.I.C., was present on invitation from the president, John Strain, M.I.C.E.

The address of the president of the Smeatonian Society of Civil Engineers, which is evidently the original engineering society, being nearly half a century older than the Institution of Civil Engineers of Great Britain, is of unusual interest and is:—

The toast of the King and Constitution having been duly honoured, the President said:—

Gentlemen, before I ask your acceptance of the time-honoured toasts of this ancient and distinguished Society, allow me in a few words to thank my fellow members for the much-appreciated honour they have done me in electing me President — an honour all the more welcome coming as it does from so many old and valued friends.

I am specially fortunate in occupying this chair on the 150th Anniversary of the foundation of the Society. This notable event took place at the King's Head Tavern in Holborn, on the 15th March, 1771, — John Smeaton, Robert Mylne and other eminent engineers and architects of the time being present. On looking over the minutes of that meeting I observed that one of the rules then formulated bears amusing evidence of Scoto-Hibernian origin, viz.: — "That each member in town shall pay a forfeit of one shilling for being absent, **unless he is out of town.**" This rule has, I fear, fallen into disuse.

Forty-seven years later this Society formed the nucleus of the "Institution of Civil Engineers," established on January 2nd, 1818. I think the parent Society has every right to be proud of its offspring, and I do not think that the child has any reason to be ashamed of its parent.

It makes one's head reel to think of what has arisen from that little meeting in the King's Head Tavern 150 years ago. The names of the past and present members of the Society form an epitome of the engineering history and development of our Empire, and to a great extent of the world at large; for there are few of the great enterprises which make for civilization in which its members have not shared. I need only mention such names as those of our founder Smeaton, the builder of the Eddystone Lighthouse and of the Forth and Clyde Canal; Mylne, with his Thames bridges, canals and roads; Watt, with his epoch-making discoveries in harnessing steam; Rennie, so great in the construction of bridges, docks and breakwaters — represented here during all these years by his descendants, and now by his great-grandson, our esteemed Honorary Treasurer. Then we have Robert Stevenson, of Edinburgh (grand-father of Robert Louis), builder of 20 lighthouses, including the famous ones on the Bell Rock and Skerryvore; Robert Stephenson, son of George Stephenson — himself the engineer of many great trunk railways as well as of the tubular bridges across the St. Lawrence at Montreal and Menai Straits; Brunel, of Thames Tunnel, Great Western Railway and Great Eastern steamship fame; Hawkshaw, with his railways, his Severn Tunnel and Clifton Suspension Bridge; Fowler, with his underground railways; Armstrong and Noble, with their hydraulic power applications and ordnance works of all sorts, both ably represented in the single person of our past President; Bateman and Hawksley, with their respective developments of great water-works — the latter represented among us in the third generation by Kenneth P. Hawksley; Meadows Rendel and Sir Alexander his son, with their chain ferries, docks and railways at home and abroad; Baker, with the Forth Bridge and the Egyptian Dams; Wolfe Barry, with the Barry and Immingham Docks, the Tower

Bridge and other great works, now represented here by his son, Kenneth A. Wolfe Barry; William White, with his reconstruction of our Navy; and a host of others who have by their works left the world better equipped than they found it.

Such men as these have in a very real sense been missionaries, for by their varied activities they have greatly helped to build up our Empire and bring light and abundance to the dark and uttermost places of the earth.

Most of those men have occupied this chair, and to be added to the illustrious roll is an honour of which a man may well be proud. I thank you all very cordially for conferring it upon me. And I can best show my appreciation by endeavouring as your President, and with your help, to maintain the great traditions of our profession.

Council Meeting at Saskatoon

Friday, August the twelfth was chosen as the day on which the meeting of Council will be held at Saskatoon. The hour of the meeting was not named, it having been decided by Council that the meeting be convened at an hour that would not interfere with the programme already arranged.

Percentage of College Graduates

In a recent letter from Dr. F. D. Adams, Dean of the Faculty of Applied Science of McGill University, he referred to an enquiry carried out by Raymond Walters on the proportion of eminent engineers in the United States who were college graduates and suggested that it would be interesting to have a similar enquiry regarding Canadian engineers.

Covering the past ten years from nineteen hundred and twelve to nineteen hundred and twenty-one, inclusive, the officers of *The Institute* show a percentage of seventy-two point seven of college graduates in nineteen hundred and twelve, and eighty-seven point five in nineteen hundred and twenty-one. The number and percentage of graduates and non-graduates on the Council of *The Engineering Institute of Canada* for the past ten years is shown in the table herewith:—

	1912	*1913*	*1914*	*1915*	*1916*	*1917*	*1918*	*1919*	*1920*	*1921*
Graduates	24	23	27	27	26	27	31	31	32	35
Percentage	72.7	69.7	81.8	81.8	78.8	79.4	81.5	81.5	80.	87.5
Non-Graduates	9	10	6	6	7	7	7	7	8	5
Percentage	27.3	30.3	18.2	18.2	21.2	20.6	18.5	18.5	20.	12.5

John Crerar Library Dedication

On the occasion of the dedication of the John Crerar Library, Chicago, held on May twenty-eighth, *The Institute* was invited to be represented. Former councillor H. R. Safford, D.Sc., M.E.I.C., kindly accepted the request of Council to represent *The Institute* on this occasion. Members will be interested in the report of Dr. Safford following his attendance at this function:—

> "In pursuance of your request of May 21st, I accepted the invitation to attend the dedicatory exercises of the John Crerar Library on Saturday the 28th. For your information I am enclosing a copy of the programme, also a newspaper clipping which are self explanatory. The Library is a very complete one and has been quite a noted asset of the City of Chicago for many years. It was endowed by the late John Crerar who was a very wealthy resident of Chicago and this, as well as practically all other endowments by him, were for general uplift and improvement purposes. That portion of his will dealing with this particular matter is somewhat unique in the rigid specification as to character of literature which is to be placed in this Library, the language of his will being to the effect that he would have 'no nastiness and dirty French novels and that the Library should be devoted to books which would interest and improve the mind and by this I do not mean hymn books and sermons, but those things which are clean, wholesome and enlightening'. The exercises were attended by possibly one hundred representatives and were very interesting. I am glad of the opportunity to have served *The Engineering Institute of Canada* in this capacity."

Entertaining Distinguished Visitors

The President and Board of Direction of the American Railway Engineering Association have again decided to meet in Montreal at *The Institute* headquarters, continuing a precedent established last year. The President and local Past-Presidents and Councillors of *The Institute* are taking advantage of the situation, and besides extend ing to the visitors the courtesies of *The Institute* headquarters, will again entertain them at dinner at the University Club.

The officers of the American Railway Engineering Association include the following: — President, L. A. Downs, vice-pres. and gen. man. Central of Georgia Ry., Savannah, Ga.; First Vice-President, J. L. Campbell, chief engineer, El Paso and Southwestern R.R., El Paso, Texas; Second Vice-President, E. H. Lee, vice-president, Chicago & Western Indiana R.R., Chicago; Past Presidents: A. S. Baldwin, vice-president, Illinois Central Railroad, Chicago, John G. Sullivan, M.E.I.C. con. engineer, Can. Pac. Ry., Winnipeg, Man., Can., C. A. Morse, chief engineer, C.R.I. and P.Ry., Chicago, Earl Stimson, chief engineer, maintenance, Baltimore & Ohio R.R., Baltimore, Md., H. R. Safford, D.Sc. M.E.I.C., asst. to president, Chicago, Burlington and Quincy R.R., Chicago; Treasurer, G. H. Bremner, district engineer, Interstate Commerce Commission, Chicago; Directors: Hadley Baldwin, asst. ch. engineer, C.C.C. and St.L. R.R., Cincinnati, Ohio, C. F. Loweth, chief engineer, C.M. and St.P. R.R., Chicago, F. L. Thompson, chief engineer, Illinois Central Railroad, Chicago, J. M. R. Fairbairn, D.Sc., M.E.I.C., chief engineer, Can. Pac. Ry., Montreal, Canada, Edwin B. Katte, chief engineer, Electric Traction, N.Y.C. R.R., New York City, F. E. Turneaure, dean, college of Eng., Univ. of Wisconsin, Madison, Wis., C. F. W. Felt, chief engineer, System A.T. and S.Fe. Ry., Chicago, G. J. Ray, chief engineer, D.L. and W. R.R., Hoboken, N.J., Geo. H. Webb, chief engineer, Michigan Central R.R., Detroit, Mich.; Secretary, E. H. Fritch, 431 South Dearborn St., Chicago, Ill.

CORRESPONDENCE

Self-Corrosion, not Stray Current Electrolysis, at Selkirk, Manitoba.

Editor, *Journal:*—

Dear Sir:

Members of *The Institute* will be interested in the news item below, taken from the Manitoba Free Press of Winnipeg, Manitoba, Canada, of May 28th, 1921, describing the finding of corrosion upon a water main in the neighboring town of Selkirk that had been buried for seven or eight years, in a locality where stray current from an electric railway could not have caused the corrosion.

In Western Canada, the corrosive action of the so-called alkaline salts, which are widely distributed through the soil of the three prairie provinces, has been acknowledged to be very destructive to all underground structures of concrete made with Portland cement; but it is only recently that suspicion has been directed to these same salts as being responsible for a large proportion of the damage to cast iron water pipes which has been recurring in Winnipeg for the last fifteen years or more. So long as there was an electric railway in operation, stray current from which could be charged with the responsibility for damage to pipes and cables, no one took the trouble to investigate the possibilities of self-corrosion or metal structures in the presence of neutral solutions of the so-called alkaline salts mentioned below, until the matter was taken up actively last year by the writer, consulting electrical engineer of the Winnipeg Electric Railway Company.

The development of engineering science, especially within the last few years, has carried with it an increasing appreciation by engineers of the importance of chemical knowledge in dealing with even the simplest and commonest materials of engineering construction. As engineers have become more familiar with advances in chemical science, particularly in recent researches in the electro-chemistry of metals, the range of application of chemistry to engineering problems, particularly on the subject of corrosion of metals, has been very greatly broadened.

Evidence is constantly accumulating that cast iron pipe is not the indestructible material that it was formerly supposed to be, even by engineers; and under certain conditions, lead and copper are found to be as vulnerable to self-corrosion, as cast iron.

The recognition by responsible chemists and engineers of the possibilities of self-corrosion cannot fail to cultivate a mere scientific point of view in determining the responsibility of stray currents from electric railways for causing corrosion damage to underground metal structures. Hitherto it has always been the fashion to attribute all corrosion to an electric railway, if there was one near enough, while cases that could not be so explained, have rarely, if ever, come to the knowledge of the public.

The fact that the gas pipes in Winnipeg, though usually nearer to the electric railway tracks than the water pipes, have suffered no destructive damage while the latter have suffered severely, also shows that there are some special electro-chemical conditions favourable to the gas pipes that do not exist in the case of the water pipes; though from the point of view usually taken by electrolysis experts, one set of pipes ought to be damaged as badly as the other.

The only scientific explanation of this fact thus far advanced, is that for some reason or other, there is less moisture in the soil next the gas pipes than in that next the water pipes.

Neither set of pipes has been electrically drained to the railway power stations for many years, but both sets of pipes have been equally exposed to access of stray current.

Now that self-corrosion of cast iron pipe is found to be perfectly possible under soil conditions hitherto thought to be harmless, more interest will be taken in the use of testing equipment which has been recently developed for determining with accuracy whether a buried conductor is really positive to the earth, which is the only condition where stray current can be blamed for corrosion damage.

An examination by a competent electro-chemist can be depended upon to determine the possibility of self-corrosion, in instances where stray current cannot be found to which to attribute it, or where the current is flowing *into* a pipe and not out of it. The results of research work now being conducted along these lines will be of special interest when completed, because in connection with the electrical testing methods recently developed, it will now be possible to settle an electrolysis controversy on a basis of readily established electrical and chemical facts, instead of the conjecture, fear or prejudice which often control procedure in such a situation. The article follows, prefaced by interviews with Winnipeg city officials.

W. Nelson Smith, M.E., M.E.I.C.

Winnipeg, June 8th, 1921.

Pipe Corrosion by Chemical Action Will be Studied

Investigation Shows Soil Chemicals May be Responsible for Supposed Electrolytic Damage.

Considering as strictly tabu the problem whether damage to water mains might be caused by electrolysis or by chemically active salts in the earth which enclosed them, city officials have refused to make any definite statement regarding the damage effected in several places to the mains which carry the city's domestic supply of water.

T. H. Hooper, operating superintendent of the waterworks system, when questioned, stated that all he was concerned in was the repair to the mains. That damage had been done to the extent of several thousand dollars was certain, but what that damage was caused by he would have to leave to the experts to say. He might have his own personal opinion, but it was for the experts to decide the cause of the damage.

Referring to the fact that water mains were similarly damaged in other cities, Mr. Hooper said he believed Winnipeg was further advanced in the study of the matter than any other place. What were problems to them had gone into the A, B, C class locally.

F. A. Cambridge, city electrician, also refused to make any definite pronouncement on the matter because it was being dealt with by a special committee.

But a quite different aspect has been created by the visit paid on May 19 to the grounds of Selkirk mental hospital, by a party of professional chemists and engineers from Winnipeg. They made a personal inspection of a six-inch water main, about 100 feet of which had been recently exposed in the course of excavating for the pipe tunnel between the new hospital and the boiler house. The party consisted of the following: A. Blackie, city chemist, Winnipeg; A. G. Phillips, assistant to Mr. Blackie; W. Aldridge, assistant city engineer of Winnipeg; T. H. Hooper, superintendent of water department, Winnipeg; Professor J. N. Finlayson, head of the civil engineering department of the University of Manitoba; Douglas McLean, C.E., chief engineer, Manitoba drainage commission; Dr. C. B. Clevenger, professor of agricultural chemistry, Manitoba Agricultural college; E. L. C. Forster, chemist, Dominion government department of health; G. W. Rogers, city engineer, municipality of St. James; Dr. J. W. Shipley, assistant professor of chemistry, University of Manitoba; and W. Nelson Smith, M.E., consulting electrical engineer, Winnipeg Electric Railway company.

As the water supply system of the hospital is secured from wells drilled on the property to a depth of 250 to 300 feet, and the piping system is entirely separated from the Selkirk water supply, and as the hospital is more than half a mile from the western outskirts of the town, and not less than 1¼ miles from the northern extremity of the Selkirk trolley line, it was said to be quite outside any possible path of stray current from the electric railway. The only electric current on the property is a 60-cycle alternating current for lighting, and the United States Bureau of Standards, it was pointed out, had proved by exhaustive and long-continued experiment, that it was impossible for an electric current of this character to cause destructive electrolytic action on buried metal structures.

The pipes examined, although they had not been laid for more than eight years, were shown to be affected by some corrosion of the cast iron, well advanced in many spots. Several members of the party dug the products of the corrosion out with their pocket knives, to a depth of one-sixteenth to one-eights of an inch, not only near the joints but in the middle of the pipe.

The progress of corrosion was observed in its various stages, and the corroded metal in the pits eaten into the pipes was similar in appearance to the products of corrosion observed on damaged water pipes in Winnipeg. All such damage, wherever it had happened in the city, it was stated, had always been attributed solely to electrolysis from stray currents leaking from the electric railway tracks.

The soil on and near the pipe was examined and found to compare very closely, in general appearance and composition, with the soils in which the Winnipeg water pipes are buried, many samples of which from various parts of Winnipeg and adjoining municipalities, have been examined during the past year both by Mr. Blackie and Dr. Shipley.

The presence of soluble salt crystals in considerable quantity was also observed by all the party on clay freshly excavated from new trenches in the street in front of the hospital. The similarity of this clay and its salt content, to the clay and its contained salts as met with all over Winnipeg and vicinity was remarked upon by all present.

This water pipe had thus been imbedded in earth containing alts that are known to be chemically active, and further, by reasons of its location, had been entirely free from access of stray direct current, which can only dissolve the metal where it leaves a buried pipe to enter the surrounding earth. Stray-current electrolysis was, therefore, admitted by all the party to be impossible under the circumstances.

The only inference that could be drawn from the facts noticed by the party was that the observed corrosion could only have been caused by the chemical activity of the solutions of the so-called alkaline salts.

It was further pointed out that it had also been recognized for several years past, by practising civil engineers, and more recently by public authorities and the public generally, that these alkaline salts, the sulphates, chlorides, carbonates and bi-carbonates of magnesium, calcium and sodium, which are widely distributed through the soil of western Canada, are very corrosive to concrete made of Portland cement, no matter how carefully the concrete is mixed and deposited.

Chemical research work started about a year ago under the direction of W. Nelson Smith, M.E., and conducted personally by Dr. J. W. Shipley in the laboratory of the University of Manitoba, has brought to light many facts hitherto unsuspected either by the engineering profession or by the public, respecting the behaviour of commercial cast iron, lead, and copper, in contact with neutral solutions of the above so-called alkaline salts. This research is now so far advanced that a definite report on the main outstanding facts will be forthcoming during the present summer.

Pipe corrosion, as observed by the party of chemists, engineers and specialists, it was urged, thus fairly comes into the same category as the corrosion of concrete, with its accompanying results of collapsed sewers, culverts, piers and foundations. Henceforth, pipe corrosion will receive the attention of professional scientists, as a matter of public concern of equal importance with the corrosion of concrete.

The western professional meeting of **The Engineering Institute of Canada** will, in August, discuss at some length the subject of cement and concrete corrosion. A cement research committee of **The Institute** has recently been formed, composed of the leading civil engineers of the three prairie provinces. The Manitoba representation on this committee is headed by Professor Finlayson.

As nearly all the members of the party who viewed the self-corrosion of the pipe at Selkirk, are members either of **The Engineering Institute** or of other scientific societies of national scope, the whole subject of the destruction of underground pipes by stray current electrolysis or by self-corrosion, has now been brought to a stage where it can be dealt with upon a new and purely scientific basis, in which all the relevant facts of engineering, electro-chemistry, and local soil condition, can be given their proper weight in reaching a fair and just conclusion.

The same issue also contained the following item on concrete corrosion in Transcona, 7 miles from Winnipeg:—

A big break in the Transcona main sewer on Nairn road has recently been discovered, and is being repaired. The trouble was caused by the sewer being eaten away with alkali, and about 50 feet is affected. Repair work is necessarily slow on account of having to place a drain within the sewer to take away the water, and concrete is being poured in the affected spot. The job is a big one, and is expected to take some time to complete.

Invitation to Western Canada Irrigation Association Convention

May 30, 1921.

Editor, *Journal:* –

Dear Sir:

The Fifteenth Annual Convention of the Western Canada Irrigation Association will be held at Vernon, British Columbia, July 27th to 30th.

The Engineering Institute is entitled to representation at this Convention by three delegates, and I trust it will be possible for you to be fully represented.

A very interesting programme dealing with many aspects of irrigation farming and irrigation engineering is being arranged, and I feel sure you would find yourself amply repaid by attending this important Convention.

I am advising you of this event in good time so that you may reserve these dates.

Faithfully Yours,
JAMES COLLEY,
Secretary.

Western Canada Irrigation Association
P. O. Box 2018
Calgary, Alta.

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Enquiry *re* Cleaning Water Main

June 20, 1921

Editor, *Journal:*—

Dear Sir:—

I should be very much obliged if you could put us in touch with firms, in a position to supply tools and give advice on the cleaning of an 8″ water main, 17800 ft. long, also with one or two firms of experience who contract for that class of work.

Yours truly,
THE DOME MINES COMPANY LIMITED,
Per W. F. J. COSSER, A.M.I.E.E.
Mechanical Engineer.

Mine Office, South Porcupine, Ont.

EMPLOYMENT BUREAU

To make this department more valuable it is proposed that in future advertisements of situations vacant should state salary, and give details of requirements.

Situation Vacant

Civil Engineer

Assistant engineer for employment in municipality in Quebec, must be civil engineer, competent in electrical and mechanical work. Knowledge of French and English desirable. Salary about $2100.00 per annum. Box 201.

ELECTIONS AND TRANSFERS

On June 21st, 1921, the following admissions and transfers were effected:

Members

Dan John Albertson, of Kalamazoo, Mich., private practice as arch't., surveyor and engr.; Jaffray Dacre Alder, of Montreal, Que., plant supt., Darling Bros. Ltd.; Shirley Barr, of Montreal, chief engr., Canada Cement Co.; Richard Thomas Bell, of Toronto, Ont., engr., traffic dept., Toronto Transportation Comm'n.; Robert Fleming, of Toronto, Ont., member of firm Wood, Fleming & Co., Financial Agents and Contractors; William Arthur Beaver Hicks, of Montreal, Que., Grad. S.P.S. (Mech. and Elect'l Engr'g.), (Univ. of Toronto), engr., hydraulic dept., Dominion Engr'g. Works, Lachine; James Hyslop, (Heriot Watt College, Edinburgh), of Toronto, Ont., with Kerry & Chace, Toronto; Henry George Kennedy, B.A.Sc. (Univ. of Toronto), gen. supt., Miller Lake O'Brien Mine, Gowganda, Ont.; Frank McDonell, (Royal Univ. of Ireland), of Ottawa, Ont., chairman, Board of Steamship Inspection, Marine Dept., Dom. Govt.; Royal Harp Montgomery, B.A.Sc. (Honours), (Univ. of Toronto), Topographical Surveys Branch, Dept. of the Interior, Calgary; Bertram Poidevin Richardson, of Amherst, N.S., res. engr., Lockwood Greene & Co., Montreal; James Norman Smith, of Toronto, Ont., research engr., Toronto Power Co., Research Divn.; Charles Hermann Tillett, B.S. (C.E.), (Purdue Univ.), of Montreal, Que., signal engr., G.T.R.; Arthur Vincent Trimble, B.A.Sc. (Univ. of Toronto), of Toronto, Ont., in charge of constrn. work, H.E.P.C. of Ontario; Henry Wellwood, of Toronto, Ont., Grand Trunk Arbitration; Benjamin Thomas Weston, (Univ. of Maine), of Temiskaming, Que., res. engr., Riordon Co. Ltd.; Reginald Henry Wood, of Halifax, N.S., engr. mgr., H.M.C. Dockyard, Halifax, N.S.

Associate Members

Paul Ackerman, (Swiss Federal Poly. Coll., Zurich), of Montreal, Que., elect'l. engr., Shawinigan Water & Power Co.; Thomas Alexander Allan, (Royal Glasgow Tech. Coll.), of Montreal, chief signal insp'r., G.T.R.; Charles Albert Allen, of Strathmore, Que., Bell Telephone Co. of Canada; Joseph Banigan, B.A.Sc. (Univ. of Tor.), of Toronto, Ont., member of firm Banigan, Armstrong & Thompson & Griffenhagen & Associates; Nelson Barritt, (Penna. State Coll.), of Winnipeg, Man., dist. engr., reclam. dept., Man. Govt.; Thomas Holmes Bartley, B.A.Sc. (Univ. of Tor.), of Ottawa, Ont., asst. controller of surveys, Topog'l. Surveys Branch, Ottawa; Garnet Lawrence Berkeley, (S.P.S., Univ. of Tor.), of Toronto, Ont., asst. land engr., Toronto Harbour Commission; William Harry Basil Bevan, (S.P.S., Univ. of Tor.), of Toronto, Ont., asst. dist. engr., C.N.R., Toronto; Albert Reginal Black, of Toronto, Ont., with Barber, Wynne-Roberts & Seymour, Consltg. Engrs.; James Fager Blair, (S.P.S., Univ. of Tor.), of Toronto, Ont., designing engr. and chief insp'r., Toronto Harbour Commission; Robert Thomson Blair, Lieut., (Royal Tech. Coll., Glasgow), of Ottawa, Ont., junior engr., drainage divn., reclam. service, Dept. of the Interior; Perry Archibald Borden, of Toronto, Ont., B. Sc. (E.E. with Honours.) Queen's University H.E.P.C. Laboratories, Toronto; Ernest Turner Bridges, of Toronto, Ont., chief engr., McGregor & McIntyre; George Patrick Brophy, (McGill Univ.), of Ottawa, Ont., P.W.D. Canada; James Roy Burgess, B.A.Sc., (Univ. of Tor.), of Toronto, Ont., mech. supt., Staunton's Ltd.; Nathaniel Alfred Burwash, B.A.Sc. (Univ. of Tor.), of Toronto, Ont., Dept. of Public Highways, Toronto; John Kenneth Butler, of East Wabana, Nfld., elect'l. supt., Dom. Iron & Steel Co.; Harry Lister Cairns, (Heriot Watt Coll., Edinburgh), of Shaunavon, Sask., instr'man C.P.R. constrn.; Joseph Walter Sands Chappelle, (Queen's Univ.), of Edmonton, Alta., asst. engr., C.N.R.; William Whelan Cushing, (Baltimore Poly. Inst.), of Hamilton, Ont., chief dftsman. and in charge of bridge dept., Hamilton Bridge Works Co., Ltd.; Antoine Valentine Delaporte, B.A.Sc. (Univ. of Tor.), of Toronto, Ont., in charge of research work, Experimental Station of Prov. Board of Health of Ontario; Earle Munro Dennis, B.Sc. (Queen's Univ.), of Ottawa, Ont., Topog'l Survey Branch. Dept. of the Interior; Leon Snell Dixon, B.S. (M.E.) (Maine Univ.), of Mattawa, Ont., prin. asst. engr., Riordon Co. Ltd.; George Collier Draper, B.Sc. (McGill Univ.), of Montreal, Que., res. engr., Canadian Explosives Ltd. at Brownsburg; William Bowie Dunbar, B.A.Sc. (Univ. of Tor.), of Dunbarton, Ont., demonstrator in drawing, Faculty of Applied Science, Univ. of Toronto; Hugh Joseph Dunne, of Ottawa, Ont., first asst., Geodetic Levelling Staff, P.W.D., Ottawa; Norman Isaac Evans Edwards, of St. Lambert, Que., dftsman, C.P.R.; John Attwill Ellis, (City & Guilds, London, England), of Moncton, N.B., office engr., C.N.R.; Nathan Louis Engel, B.Sc. (McGill Univ.), of Montreal, Que., Montreal Public Service Corpn.; Erik Eriksen, (Trondhjem Univ., Norway), of Toronto, Ont., struct'l. dftsman., bridge dept., C.N.R., Eastern Lines, Toronto; Harold Forsyth Finnemore, B.Sc. (Queen's Univ.), of Moncton, N.B., dftsman, C.N.R.; Richard James Fisher, (Universities of Sheffield and Birmingham, England), of Sydney, N.S., chief dftsman., engr'g. dept., Dominion Iron & Steel Co.; Arthur Fraser, (Royal Indian Engr'g. College, Cooper Hill), of Calgary, Alta., engr'g. clerk, Topog'l. Surveys Br., Dept. of the Interior; William J. Fulton, B.A.Sc. (Hons., Univ. of Tor.), of Walkerville, Ont., asst. engr., Morris Knowles Ltd., Windsor, Ont.; Walter Elten Logan Hall, (Dalhousie Univ.), of Hantsport, N.S., divn. engr., Prov. Highways Board, Nova Scotia; Adam Hay, (Robert Gordon's College, Aberdeen), of Toronto, Ont., Ontario Public Highways; James Oliver Hogg, Jr., of Kansas City, Mo., estimator and constrn. engr., Collin Bros. Constrn. Co., Kansas City; Ernest James Holland, of Islington, Ont., asst. designing engr., Toronto Harbour Comm'n.; Charles Vincent Hope, of Islay, Alta., res. engr., C.N.R.; John Ward Hughson, B.Sc. (M.E.) (McGill Univ.), of Ottawa, Ont., Montreal Engr'g. Co. Ltd.; Allan D. Jost, of Sydney, N.S., field engr. and asst. supt. tracks and mtce., Dominion Iron & Steel Co.; Herbert Crosby Kendall, B.Sc. (E.E.) (Queen's Univ.), of Toronto, Ont., bldg. and mech. supt., New Union Station, Toronto Terminals Rly. Co.; Howard Kennedy, B.Sc. (McGill Univ.), of Dunrobin, Ont., with Lockwood Greene & Co. of Canada Ltd.; Emile Lacroix, B.A.Sc. (C.E., M.E.) (Ecole Polytechnique), of St. Eustache, Que., asst. city engr., City of Outremont; Arthur D'Orr LePan, B.A.Sc. (Univ. of Tor.), of Toronto, Ont., supt. of University of Toronto; Albert Leroux, C.E. (Poly. School, Laval), of Outremont, Que., Montreal Water Board; Clarke John Madgett, (Armour Inst., Chicago), of Welland, Ont., mgr., Standard Steel Constrn. Co.; Hugh Christopher Maguire, (Univ. of Tor.), of St. Catharines, Ont., junior engr., Section 5, Welland Ship Canal; Guy Reeves Marston, (Birming Tech. School), of Simcoe, Ont., supt. county roads, Norfolk Co.; Edward Carrington MacDermot, B.Sc. (C.E.) (McGill Univ.), of Sanderstead, Surrey, England, engr. and dftsman., bridge dept., London County Council, England; Alexander MacDonald Mackenzie, B.A.Sc., (E.E.) (Univ. of Tor.), of Lachine, Que., transmission engr., Bell Telephone Co.; Alexander Ernest MacRae, B.Sc. (Chem. Engr.) (Queen's Univ., Canadian Patent Office, Ottawa; Horace Neville Mason, of Toronto, Ont., contracting engr. in charge of tenders etc. for Toronto office, Dominion Bridge Co.; James McAdam, (Heriot Watt Tech. College), of Toronto, Ont., engr. of constrn., Barber, Wynne-Roberts & Seymour, Consltg. Engrs.; Michael James McNeil, of East Wabana, Nfld., asst. mgr., Wabana Mine, Dominion Iron & Steel Co.; Richard John McNeil, of Sydney, N.S., asst. to Supt. of mtce of way Dom. Steel and Coal Co; John J. McNiven, B.Sc. (McGill Univ.), of Ottawa, Ont., gen'l. mech. engr., D.S.C.R.; Clarence Stephen Millard, of Copper Cliff, Ont., International Nickel Co. of Canada; Walter St. John Miller, (South London Polytechnic), of Calgary, Alta., chief dftsman., reclam. service, Dept. of the Interior, Calgary; Charles William Milton, (Mount Allison Univ.), of Moncton, N.B., first asst., divn. engr's. office, C.N.R.; William Cunningham Morham (Heriot Watt College, Edinburgh), of Toronto, Ont., dftsman, hydraulic dept., H.E.P.C. of Ontario; Hugh Dearle Palser, of Gowganda, Ont., engr., Miller Lake O'Brien Mine, Gowganda; Alexander Wilson Paterson (Heriot Watt Inst., Edinburgh), of Winnipeg, Man., res. engr., C.P.R.; William James Peaker, of Ottawa, Ont. (Grad. S.P.S. Univ. of Toronto), Office engineer, Natural Resources Intelligence Branch, Dept. of the Interior, Ottawa; Thomas H. Plunkett, of Meaford, Ont., (B.A.Sc., Univ. of Toronto '04), Chairman of Committee, Town of Meaford, Ont.; Cecil George Porter, of Montreal, B.Sc. (McGill Univ. '11), Mgr. Douglas Milligan Co. Ltd., Montreal; Willis Horatio Roberts, of Perth, Ont., (Queen's Univ.); Allan Edward Rowbotham, of Edmonton, Alta., Asst. to Major G. W. MacLeod, Edmonton; Walter Albert Rush, of Ottawa, Dominion Supt., Radio Stations east of Winnipeg; Allan Usill Sanderson, of Toronto, Ont., B.A.Sc. (Univ. of Toronto '09), Supt., Filtration Plant, Toronto; Daniel Anthony Scarnegie, of Montreal, (Mass. Inst. of Tech. '07), Chief Signal drftsman, G.T.R.; Alexander Scott, of Charlottetown, P.E.I., Div. Engr., C.N.R. in charge of P.E.I. Division; Frank Hugh Cotteril Sefton, of Toronto, with Kerry & Chace, Ltd., Toronto; Frank Lawrence Smith, of Hamilton, Ont., Checker in Drfting Dept., Hamilton Bridge Works Co., Hamilton; Henry Denne St. Alban Smith, of Calgary, Alta. (R.M.C. '11), Engr., Irrigation Div., Dept. of the Interior, Calgary; Roy Foster Smith, of Oakville, Ont., B.Sc. (Queen's Univ. '16), Res. Engr., Township of Trafalgar, Ont.; Edgar Thomas Spidy, of Montreal, Asst. Supt. Dominion Engineering Works, Rockfield, Que.; Charles Talbot, of London, Ont., County Engr., County of Middlesex; Norman Albert Thompson, of Ottawa, Ont., B.Sc. (McGill Univ. '12), Junior engr., Reclamation Service, Dept. of the Interior, Ottawa; Edward L. Thorne, of Halifax, B.Sc. (N.S. Tech. Coll. '10), Gen. Supt., Halifax Relief Commission, Halifax; Grover Carleton Torrens, of Moncton, N.B. B. in C.E. (Univ. of N.B. '06), Div. engr., Moncton Div. Eastern Lines C.N.R.; William Beauchamp Trotter, of Calgary, Alta., Mgr., The James Ballantyne Co. Ltd., Calgary Branch; Edwin Stewart Turner, of Allenburg, Ont., Office engr., Section 5, Welland Ship Canal; Bruce Vernon, of Montreal, C.E. (Penn. Univ. '08), Principal asst. engr., Montreal Tramways Co.; James Harold Wallis, of Toronto, (S.P.S. Univ. of Toronto), Engr., Canada Creosoting Co., Toronto; J. Frederick D. Withrow, of Ottawa, (Grad. S.P.S. Univ. of Toronto), Examiner of Patents of invention, Patent Office, Ottawa; Francis Edward Wootton, of Saskatoon, Sask. (Univ. of Sask.), Acting Trainsmaster, C.P.R.

Associates

William Earl Doan, of Toronto, Vice-President, Canada Creosoting Co. Ltd., Toronto; Edward Fisher Drake, of Ottawa, Ont., Director in charge of Reclamation Service, Dept. of the Interior, Ottawa; Richard Veech Look, of Toronto, President, Canada Creosoting Co. Ltd.,Toronto; Ira Johnson Nichols, of Jasper Alta., bridge inspector, C.N.R.

Juniors

James Cullam Anderson, of Prince Rupert, B.C., Instrumentman in charge of Mtce. of Way party, Prince Rupert, B.C.; Henry Musgrove Blaiklock, of Montreal, Senior Instrumentman, Eastern Lines, G.T.R.; Troy Eugene Blinco, of Grand Mere, Que., Asst. field engr Laurentide Co., Grand Mere, Que.; Elliot Stirling Campbell, of Halifax, N.S., dftsman. Provincial Highways Board of N.S.; George Herbert Carson, of Montreal, field engr., Three Rivers Pulp and Paper Co. Ltd.; Vernon Russell Davies, of Three Rivers, Que., B.Sc. (McGill Univ. '20), Junior asst., St. Maurice Lumber Co., Three Rivers, Que.; Edmond Fortin, of Sudbury, Ont., transitman, C.P.R.; Herbert John Geale, of Toronto, with Toronto Transportation Commission; Edgar Clarence Higgins, of Toronto, with H.E.P.C., Toronto; Sydney Stuart Jones, of Montreal, instrumentman, in charge of survey of property and mine, North American Magnesite Co., Calumet, Que.; James Alexander Joslin, of Toronto, structural checker, Dominion Bridge Co. Ltd.; Fennell Thompson Julian, of Morrisburg, Ont., B.A.Sc. (Univ. of Toronto), St. Lawrence Development, H.E.P.C.; Jack Harold Leech, of Cedars, Que., instrumentman and dfting. for Cedars Mfg. & Power Co., Cedars, Que.; William James Moore, of Ottawa, Ont., asst. to chief of Borings, D.P.W., Ottawa; Alfred Allan Outram, of Port Hope, Ont., Instrumentman, Dept. of Public Highways of Ontario; Irving Holman Parker, of Montreal, with Milton Hersey Co. Ltd.; Frederic Arnold Sproule, of Kingston, Ont., fourth year student Queen's Univ.; Connell Gerald Steers, of Ottawa, asst. to dist. engr., D.P.W., Ottawa; George Stuart Walker, of Kingston, Ont., third year student, Queen's Univ.; Lloyd Amor Blachford Whitehouse, of Hamilton, Ont., asst. to chief engr., W. H. Yates Construction Co.; Aubrey Hume Whitman, of Halifax, N.S. (Acadia Univ. Diploma App. Sc.), instructor electric engineering, N.S. Tech. College; George Howard Wood, of Ottawa, B.A.Sc. (Univ. of Tor. '17), asst. hydraulic engr., Reclamation Service, Dept. of the Interior, Ottawa.

Transferred from the class of Associate Member to that of Member

Joachim Antonisen, of Port Arthur, Ont. (Univ. of Dresden, Saxony), City engineer, Port Arthur, Ont.; Havelock H. Charles, of Culver, Minn., div. engr., Highway Dept., St. Louis County; Arthur George Dalzell, of Toronto, consulting engr., Clay Products Agency Ltd., Toronto; Franklin Hugo Kitto, of Ottawa, Exploratory engr., Natural Resources Intelligence Branch, Dept. of the Interior, Ottawa; Harold Robinson McClelland, of Montreal, Que., Vice-President and General Manager, N. E. McClelland & Co. Ltd.; Robert Crawford Muir, of Toronto, chief engr., of County Roads, Province of Ontario; James Morrow Oxley, of Toronto, Member of firm, Chapman, Oxley and Bishop, Architects and Engrs.; Lewis Traver Rutledge, of Kingston, Ont., B.A.Sc. (Univ. of Tor.), Asst. Professor of Mech. Engr'g., Queen's University, Kingston; Harry Stewart Van Scoyoc, of Montreal West., B.S. (C.E. Univ. of Penn.), consulting engr., Toronto-Hamilton Highway Comm'n., also consulting engr., Service and Promotional Dept.s Canada Cement Co. Ltd.

Transferred from the class of Associate to that of Member

John James York, of Montreal, General Works Mgr., St. Lawrence Sugar Refinery Co., Montreal.

Transferred from the class of Junior to that of Associate Member

Thomas Hamilton Bacon, of Arnprior, Ont., B.Sc. (McGill Univ. '11), asst. engr., McLachlin Bros. Ltd., Arnprior, Ont.; Orville Mervon Falls, B.A. Sc., Hons., Univ. of Toronto, of Toronto, Ont., Engr. of Constr., Barber, Wynne-Roberts and Seymour, Consulting Engrs.; Edward Caruthers Little, of St. Margaret's Bay, N.S. B.Sc. (Civil) (McGill Univ. '15), construction engr., for L. G. Loomis & Sons, on the construction of St. Margaret's Bay Power Development; George Humphrey Nelson Monkman, of Winnipeg, res. engr., C.P.R.; William Fleming Noonan, of Napanee, Ont., B.Sc. (C.E.) (Queen's Univ.), Res. engr., Dept. of Public Highways of Ontario, Kingson Trenton Section; William Brighthelm Redman, of Toronto, B.A.Sc. (Univ. of Tor.), designing engr., Bridge Dept. C.N.R., Toronto; Cecil Raymond Scott, of Toronto, B.A.Sc. (C.E.) (Univ. of Toronto), Senior Partner, Scott & Maddock, Toronto.

Transferred from the class of Student to that of Associate Member

Fred Graham Earle, of Calgary, Alta., asst. engr., C.N.R.; Laurence Herbert Laffoley, of Montreal, B.Sc. (Civil) (McGill Univ. '16), dftsman., Engineering Dept., C.P.R.; Frank P. McAuliffe, of Welland, Ont., B.Sc. (C.E.) (Queen's Univ.), in charge of construction work, Section 5, Welland Ship Canal; Clarence MacLeod Pitts, of Ottawa, B.Sc. (C.E. McGill Univ.), in charge of all works of Pitts Construction Co.; Frank Dunbar Pringle, of Hamilton, Ont., B.Sc. (Queen's Univ. '17), municipal engineering and city surveys, MacKay, MacKay and Perrie, Hamilton; William Augustus Richardson, of Courtenay, B.C., B.A.Sc. (Univ. of Tor. '12), asst. district engr., D.P.W., B.C., in charge of Comox district; Harold Wilfred Wagner, of Toronto, B.A.Sc., (Univ. of Toronto '14), engineering staff, H.E.P.C., Niagara Falls, Ont.; Howard J. Williams, of Augusta, Me., B.Sc. (Queen's Univ.), asst. engr., Maine Water Power Comm'n., Augusta, Me.; Henry Stanton Windeler, of Grand Falls, Nfld., B.Sc. (McGill Univ.) (Grad. R.M.C.), asst. to chief engr., Anglo Newfoundland Development Co., Grand Falls, Nfld.

Transferred from the class of Student to that of Junior

William Roy Conibear, of Niagara Falls, Ont., rodman, H.E.P.C., Niagara Falls; Herbert Walter Dorken, of Westmount, Que., B.Sc. (M.E. McGill Univ.), special representative for Eastern Canada, for Northey Co. of Canada; Ronald Harrison, of Birch Cliff, Ont., B.A.Sc. (Hons) (Univ. of Toronto), dftsman., Hydraulic Dept., H.E.P.C. of Ontario, Toronto; A. Frank McMulkin, of Ottawa, dftsman. Dept. of Railways and Canals, Ottawa; Charles Sager Parke, of Cleveland, Ohio, B.Sc. (McGill Univ.), with Harshaw, Fuller & Goodwin Co., Cleveland, Ohio; George Elgin Stephenson, of Toronto, B.A.Sc. (Univ. of Toronto), asst. to T. D. Mylrea, Consulting Engineer; David Karl Crawford Strathearn, of Morrisburg, Ont., B.A.Sc. (Univ. of Toronto), engr., on St. Lawrence River investigations for H.E.P.C. of Ontario.

OBITUARY

Lieut. Emile Probst, S.E.I.C.

Croix de guerre, Chevalier de la Légion d'honneur

Lieut. Emile Probst, S.E.I.C., born of French parents at Newark, New Jersey, on the 22nd of May 1896, came to Canada in his early years and his home was at Quebec.

He was educated at the Commercial Academy of St-Hyacinthe, P.Q., and, in 1911, entered the Ecole Polytechnique, Montreal, where he was studying civil engineering when called to the colours and sailed for France, the 5th of June 1915.

He first served with the 4ième Zouaves Regiment. In 1916, he was admitted at the Ecole de St-Cyr from which he graduated "Aspirant" the 15th of February 1917, and was transferred to the 3ième Zouaves Regiment which was ordered to the Verdun front. There, he was decorated with the "croix de guerre" (avec palmes) for his gallant deed at Hill 304, in Sept. 1917.

LIEUT. EMILE PROBST, S.E.I.C.

Later, he fought on the Somme.

On June 13th, 1918, he was commissionned a "Sous-Lieutenant" in the 9ième Zouaves and was taking part in the big July offensive when he met his death in the lead of his Company at Saconin-Breuil, Aisne, July 21st, 1918.

He was made a Chevalier de la Légion d'honneur by the French government on March 13th, 1920.

Emile Probst was a quiet and modest young man but his many friends know of his noble character and will remember him with a pious and proud emotion.

PERSONALS

J. Jonsson, A.M.E.I.C., has been appointed superintendent of utilities at Prince Albert, Sask.

*

D. O. Wing, A.M.E.I.C., has been appointed local manager, Holdred Collieries of West Virginia.

*

C. E. Fraser, Jr.E.I.C., has been engaged by the firm of James, Proctor and Redfern Limited, Toronto, Ont.

*

R. B. Harkness, A.M.E.I.C., has been appointed Commissioner of Gas with the Department of Mines, Ontario.

JULIAN C. SMITH M.E.I.C.

Julian C. Smith, M.E.I.C., has been elected President of the Canadian Electrical Association.

*

R. R. Bostwick, Jr. E. I. C., has been transferred by the Canadian National Railways to engineer of Standards Office, Canadian National Railways, Toronto, Ont.

*

J. E. Porter, A.M.E.I.C., has resigned from the Canadian Steel Corporation and has accepted an appointment with J. J. Newman, M.E.I.C., in Windsor, Ont.

*

Hugh A. Lumsden, A.M.E.I.C., recently with the Abitibi Power and Paper Company at Iroquois Falls, Ont., has been appointed district engineer, Department of Highways, Oakville, Ont.

*

W. R. Bonnycastle, M. E. I. C., has formed a partnership with R. G. Leckie, A.M.E.I.C., and D. E. Rice in the firm of Leckie, Bonnycastle and Rice, consulting engineers, with office in the Canada Life Building, Vancouver, B.C.

*

Professor R. C. Wallace of the Manitoba University, Commissioner of Northern Manitoba for several years, will retire from the commissionship September 1st, it was announced to-day. He will resume his duties with the University. A successor has not been appointed.

*

Lt.-Col. E. V. Collier, D.S.O., A.M.E.I.C., has accepted an engagement with the Anglo Persian Oil Company, Limited, to carry on developments for that Company in Persian territory, the result of which it is expected will be the construction of a new port on the Persian Gulf.

H. L. Seymour, A. M. E. I. C., has been appointed Secretary of the Committee arranging for the Toronto Convention of the American Association for the Advancement of Science to be held under the auspices of the University of Toronto and the Royal Canadian Institute, December 27-31, 1921.

*

Lt.-Col. Rene A. Girouard, A.M.E.I.C., has been appointed warden of St. Vincent de Paul Penitentiary duties to commence at once. Col. Girouard was overseas as a company commander of the 22nd Battalion and later was made commanding officer of the 178 Battalion, C.E.F. Since coming home from the war he has been in the service of the C.P.R. and was resident engineer and assistant superintendent at Sudbury.

*

PATRICK PHILIP, A.M.E.I.C.
Victoria, B.C.
Chief Engineer, Department of Public Works, Victoria, B.C.

*

Town Planning Notes and Comments

H. L. Seymour, A.M.E.I.C.

NOTE: — *In order to make this column of wide interest to members of The Institute, personals and items of town planning interest will be appreciated. Address: H. L. Seymour, A.M.E.I.C., 40 Jarvis Street, Toronto.*

Second Annual Meeting of The Town Planning Institute of Canada

The second Annual Business Meeting of the Town Planning Institute of Canada was held at the Chateau Laurier, Ottawa, Ontario, on Friday and Saturday, May 27th and 28th., 1921.

The annual dinner was the occasion of many valuable and practical town planning talks. The Government was represented by the Hon. G. D. Robertson, Minister of Labour and Senator Fowler. The former spoke largely in regard to housing and the latter, who was made an Honorary Member just before his speech, freely admitted that he was now an ardent town planner and in particular a disciple of Noulan Cauchon, A.M.E.I.C., who had recently addressed the Senate on the subject of "National Resources". The other speakers included the retiring President, Thomas Adams, Mayor Plant of Ottawa, Dr. Adam Shortt, C.M.G., of the Dominion Archives, and Noulan Cauchon, A.M.E.I.C. The latter, who has recently been appointed Chairman of the Town Planning Commission of Ottawa, outlined a number of matters on which the Commission are already active. One was the gyration of traffic around certain blocks, making them in effect one-way streets, and the other of rounding curbs at street corners to 25 foot radius.

On Saturday morning the following papers were presented:

(1) The Paris Town Planning Competition — by Professor A. Berrington of Toronto.

(2) New Town Planning Powers in Ontario — by H. L. Seymour, A.M.E.I.C., of Toronto.

(3) Town Planning Survey of London — by H. A. Brazier, A.M.E.I.C., city engineer, London.

As Mr. Brazier was unfortunately detained at the last moment by illness, Major D. H. Nelles, M.E.I.C., of the Geodetic Survey of Canada, kindly gave a résumé of the surveys carried out at London by his department.

The meeting was brought to a close by a visit to the Parliament Buildings and to the Public Works Department where models were on exhibit, giving the members some idea of the grouping and architecture of the proposed Government buildings in Ottawa.

The following corporate members of *The Engineering Institute of Canada* were present at the sessions: Noulan Cauchon, Noel Ogilvie, J. L. Rannie, W. A. Begg, A. G. Dalzell, James Ewing, Douglas H. Nelles, A. A. Dion, H. L. Seymour, J. Clark Keith.

Notes on Annual Meeting of Town Planning Institute of Canada

The opinion was very generally expressed that the meeting recently held was one of particular practical interest. A matter that gives food for thought for all engineers engaged in municipal work was brought to the attention of the meeting by A. G. Dalzell, A.M.E.I.C., in his discussion of a paper by W. A. Begg, A.M.E.I.C., Mr. Dalzell drew attention to the unsatisfactory financial position of many of the Western Cities and then stated that in one of these Western Cities there were at present 26,000 vacant lots served with sewer and water. This he stated would, at three, per lot, provide for a great many more people than were at present living in that city, yet at this very time further extensions to the sewer and waterworks systems are being made. Municipal engineers know that to a greater or lesser extent the same thing is happening in all municipalities, but the bringing to the attention of such an outstanding case surely teaches the lesson for the need of better control in municipal development.

A Contrast in Legislation

In the United States there are a number of states, and in Canada there are a number of provinces that have comprehensive town planning legislation. As to recent legislation in the United States, the State of Indiana, among others, might be mentioned. According to the National Municipal Review for May, 1921:—

> "The city-planning and the zoning bills went sailing through the legislature with no opposition of any kind. They were introduced very late in the session but had a lively public sentiment back of them from all of the cities in the state. Both bills are purely optional, leaving it to the council of the various cities to create a city-planning commission or to pass a zoning ordinance. The commission shall consist of nine members, serving without pay, made up of five citizens appointed by the mayor, and a member of the common council, a member of the park board, the president of the board of public works and the city engineer. In the smaller cities the commission may consist of seven. Its powers are purely recommendatory except in the case of the approval of plats of real estate. It is authorized to make surveys, studies and plans with reference to the layout of streets, alleys, parks, boulevards, bridges, public buildings, transit lines, etc., for the purpose of creating co-ordinate plans for the orderly development of the city. The law provides a tax levy of not less than three nor more than eight mills on each 100 dollars of taxable property for city-planning purposes."

In Canada this year the Province of Ontario has been the scene of considerable activity as regards Town Planning Legislation. But in contrast to the experience of the State of Indiana, the City of Ottawa Bill and a general amendment to the Planning and Development Act were both thrown out. These acts, which were optional, were similar in some respects to legislation in other provinces. Several amendments to the Municipal Act (or other acts) of a town planning nature were passed however at the recent session of the Ontario legislature.

Among these might be mentioned certain zoning powers by which the councils of cities and other municipalities including townships abutting upon an urban municipality may pass, under certain conditions, by-laws in particular for prescribing detached private residence zones. By by-laws there may also be regulated, height, bulk, location and spacing and character of buildings to be erected within defined areas, and also the proportion of the area of the lot which the building may occupy. It is felt that considerable zoning powers are granted by this legislation of which it is hoped advantage will be taken by numerous Ontario municipalities.

Town Improvement

In a recent issue of the National Review, Harlean James, Secretary of the American Civic Association writes an interesting article on "Where to begin in Town Improvement". He assumes everybody is interested in gardens and states in conclusion:—

> "A town which has aroused the interest of everybody in gardens and established contact between its residents might then

venture on a park and playground campaign with some assurance of success. The street-tree programme should have brought the overhead wire evil to the front and possibly banished the wires to the alleys or back fence lines if the town cannot afford underground conduits. The treatment of streets in paving, parking, sidewalks and shade adapted to the uses of the street might well become in due time the subject of intelligent interest and so be following by actual action.

Indeed, starting from an active garden committee and a town-wide participation in garden contests, all the more intricate problems of town planning, treatment and arrangement of streets, protection of residence zones, grouping and treatment of public buildings, treatment and route of main highways connecting with other towns, all of which require expert advice and substantial expense, might be achieved through the understanding and sympathy of all the people, a method based on sound democratic principle and applied in a way to develop habits of human co-operation."

BRANCH NEWS

Vancouver Branch

J. N. Anderson, A.M.E.I.C., Secretary-Treasurer.

A general meeting of the Branch was held in the Board of Trade Auditorium, on Wednesday 8th June.

J. Alex. Walker, A.M.E.I.C., was elected by acclamation to the vacancy in the Branch Executive Committee caused through the resignation of P. Philip, A.M.E.I.C., who has gone to Victoria to assume the duties of public works engineer for the province of British Columbia.

Several matters of general interest were discussed, including the suggested joint headquarters for technical bodies in Vancouver. Power was given to the Executive Committee to deal with the matter.

After the transaction of business, Major W. G. Swan, D.S.O., M.E.I.C., delivered a most interesting talk on "Light Railways in France during the War", which was illustrated with numerous lantern slides which very graphically depicted the various phases of the construction, maintenance, operation, rolling stock, and equipment, and gave a very good impression of the work done in France by the Canadian Railway Troops.

A luncheon meeting of the Vancouver Branch was held in the Blue Room, Hotel Vancouver, on Wednesday, 25th May.

The guest of honour was Lt.-Col. Guy H. Kirkpatrick, D.S.O., Chairman, Vancouver Harbour Commission.

Major G. A. Walkem presided, and the following members were present: Messrs White, Eddy, Foreman, Hodgson, Brown, Marble, Greig, Price, Powell, Fullerton, Fairhurst, Fisken, McGown, Young, Muirhead, W. G. Swan, R. G. Swan, Tornroos, Mills, Hall, Walker, Kennedy, Archibald, Buchan, Frith, James, Smaill, Stirrett, Fox, Crysdale, and Anderson. There were also present several representatives of the Vancouver Pilot Board, the Tug-boat Owners Assoc., the Richmond Board of Trade, and the City Press.

After lunch Col. Kirkpatrick addressed the meeting, his subject being "The Administration of Vancouver Harbour".

The following phases of this were discussed: finances, capital and revenue expenditures, by-laws, dues and revenue, bunkering, booming grounds and air-harbourage, the speaker also dealt with the construction of the Ballantyne Pier, which work is now being carried out, and the projected harbour railway.

In the course of comparing the different Canadian seaports the following figures were quoted as relating to Vancouver Harbour: there are three and one half miles of deep water wharfage: the transit sheds can accommodate 100,000 tons: 320 deep sea ships entered Vancouver Harbour during 1920, the greatest number in one day being 14.

A point of special interest noted was the statement that while a few years ago it was commonly thought that Vancouver was primarily an American port, in that most of the business originated at American points, the business is now to a very large extent Canadian.

Calgary Branch

Arthur L. Ford, M.E.I.C., Secretary-Treasurer.
Floyd K. Beach, A.M.E.I.C., Branch News Editor.

During May and June there have been no meetings of the Branch as a large number of the membership are out of town on field work.

Lethbridge Northern Irrigation District

Tenders for earthworth of the Lethbridge Northern Irrigation District were opened on June 1. Grant, Smith Co., and McDonnell of Ottawa and Calgary were the successful bidders, and at the unit prices submitted the contract will amount to about $1,660,000.

The first sod was turned on June 16. This was made a ceremony in which Lieut.-Governor Brett and Premier Stewart officiated. E. F. Drake, director of reclamation, Victor Meek, A.M.E.I.C., acting commissioner of irrigation, L. C. Charlesworth, M.E.I.C., Gavin N. Houston, M.E.I.C., respectively chairman and secretary of the Irrigation Council of Alberta, as well as a large gathering of local citizens were present.

After the actual turning of the first furrow by Premier Stewart, Governor Brett addressed the gathering. He congratulated the people of the Southern part of the province on the realization of their hopes in the matter of irrigation. He expressed a thankfulness to the government for the confidence shown in irrigation and in the part they had taken in meeting the desires of the people.

Referring to the work and agitation for irrigation, he urged that this spirit of co-operation continue to make for the welfare of this part of the province and of the province as a whole.

Flood Prediction Survey

The Water Power Branch in co-operation with the Meteorological Service have made an annual flood prediction survey. This work was originally undertaken in 1916, following the floods of 1915, by the Chief Hydrometric Engineer who was then under administration of the Irrigation Office. Arthur L. Ford, M.E.I.C., district chief engineer, Dominion Water Power Branch, now administers the Hydrometric Survey, and between May 31 and June 3, Mr. Ford, together with Major G. H. Whyte, M.C., A.M.E.I.C., and N. B. Sanson, representing the Meteorological Service, carried on the annual survey, obtaining data as to depth of snow and water content in the vicinity of Lake Louise.

Mr. Ford's comments on the completion of his trip were that the water content of snow in the mountains was about average this year. Floods need not be expected from snow water alone and run-off of Bow river and tributaries for the current year is likely to be normal. In any year floods in the Bow river and North Saskatchewan river are likely to occur only when a general heavy rainfall in mountain and foothill areas comes during a period when rivers are high, whether due to runoff from snow fields or from a protracted period of rainfall. Machinery has been established providing for timely warnings of heavy precipitation in the critical localities.

Hillhurst Bridge, Calgary

The new Hillhurst bridge, Calgary's latest addition to its monumental concrete bridges, is now approaching completion and will be opened to traffic in July. The foundations were completed by the middle of February and the superstructure was started on the 18th of March, as soon as it was considered that all danger of heavy frosts was passed. The construction of the arches, involving the placing of over 3000 cubic yards of concrete was finished on May 4th. The spandrel walls had also been carried forward as close as possible behind the arches, and the sidewalk slab was proceeded with as soon as it was safe to load the supporting brackets. With the stripping of the sidewalk the handrail is now being placed and this, together with the gravel fill over the arches, should be completed by the first of July. The test cylinders made daily from the arch concrete, containing six sacks of cement to the cubic yard, have shown an average strength of 2500 pounds per square inch, and constitute a record for this district of which, we believe, the engineers in charge have every reason to feel justly proud.

Fegles Construction Company are contractors. J. F. Greene, M.E.I.C., is consulting engineer for the city, and J. J. Hanna, A.M.E.I.C., resident engineer.

Border Cities Branch

J. E. Porter, A.M.E.I.C., Secretary-Treasurer.

The regular May meeting was held in Chamber of Commerce Building on Friday evening, May 13th, 1921.

The meeting was called to order at 8.40 P.M. with Chairman A. J. Riddell, A.M.E.I.C., presiding. Those present were — Members Messrs. Allen, Bowman, Considine, Keith, McColl, Milligan, Moliter, Newman, Riddell, Thorne, Tillson, Venney; — Visiting Student Members, Coulter and Coulter, — also visitors Messrs. Dustan and Bishop.

The Chairman reported the illness of Mr. Porter and asked Mr. Thorne to act as secretary.

The minutes of the last regular meeting and of the special meeting were read and approved.

There being no business from the minutes and no correspondence, the Chairman called upon the speaker of the evening, J. Clark Keith, A.M.E.I.C., whose subject was "A Park Scheme for the Border Cities".

Mr Keith began by outlining the history of the park idea, from the formal plots of the Egyptians. He pointed the object served by city parks, and the important part they play in civic life, the points to be observed in selecting the site in a system, the advisability of profiting by mistakes of other cities.

With the aid of maps of the Border area, Mr. Keith referred to available sites for parks and difficulties to be met, and the deplorable lack of parts or even play ground areas at present in our district.

A hearty vote of thanks was tendered Mr. Keith for his very instructive address — Moved, Mr. Newman — Seconded, Mr. Milligan.

A short discussion was held on the matter of available park sites and the jurisdiction of the Border Utilities Commission over the subdivision of property for building sites and the desirability of coordinating various subdivisions within this urban area, several members speaking — Messrs. Newman, Milligan, McColl and Keith.

Mr. Riddell pointed out that this meeting would be the last until October. He regretted the fact that so many of our members have recently moved from the city and asked for co-operation during the summer in increasing our membership.

Niagara Peninsula Branch

Rex. P. Johnson, A.M.E.I.C., Secretary-Treasurer.

G. R. Taylor, A.M.E.I.C., Branch-News Editor.

The annual general meeting of the Branch was held in the Queen Victoria Park Refectory on the evening of May 18th., the retiring Chairman, W. P. Near, M.E.I.C., presiding. The business part of the meeting was preceeded by a dinner and followed by an impromptu concert of lantern slide, singing and musical selections by members of the Branch.

After dinner the Annual Report was read by the Secretary and the Financial Statement by the Auditors. The results of the voting for the executive for the following year were then announced to be as follows:—

Chairman: N. R. Gibson, M.E.I.C., hydraulic engineer, Niagara Falls Power Co.; Vice-Chairman: F. S. Lazier, M.E.I.C., res. eng., Welland Ship Canal; Executive: F. E. Sterns, A.M.E.I.C., designing engineer, Welland Ship Canal, S. R. Frost, A.M.E.I.C., mechanical engineer, American Cyanamid Co.; Secretary-Treasurer: Rex. P. Johnson, A.M.E.I.C., office engineer, Queenston-Chippawa Power Development.

The above, together with W. H. Sullivan, M.E.I.C., and H. L. Bucke, M.E.I.C., who were elected last year for two years, Lt.-Col. R. W. Leonard, M.E.I.C., H. G. Acres, M.E.I.C., and A. C. D. Blanchard, M.E.I.C., members of Council, constitute the Executive for the coming year.

A hearty vote of thanks was passed to the retiring members of the Executive and the meeting unanimously insisted on R. P. Johnson accepting an honorarium of $100. in recognition of his untiring services as Secretary-Treasurer of the Branch.

Annual Report

The Members of the Niagara Peninsula Branch:—

The outstanding feature of the year was the Professional Meeting in September, which brought fame and pride to the Branch and set a new standard for gatherings of engineers. Eight meetings of the Branch and five meetings of the Executive Committee were held during the past year. Four speakers addressed the Branch on various technical subjects, a dinner meeting was held in St. Catharine's in February and a trip of inspection was made to the Paper Mills at Thorold in October, and also a trip to the Plant of the Coniagas Reduction Co. at Thorold.

An Institute dance was held in January and proved to be a very successful and enjoyable affair. The Executive voted, $200.00 towards the expenses of this and the dance committee made a refund of $39.00.

In October the Executive Committee made a thorough study of questions of Remuneration and Institute policy and outlined courses of progressive action on these two subjects which were later ratified by the Branch members and sent on to the respective committees of **The Institute** for furtherance by **The Institute** at large.

The question of Legislation has been an outstanding one during the past year and a definite position on this matter has been taken by the Branch. A standing Legislation Committee of the Branch has greatly helped the Executive by advising upon various phases of this subject and has made two reports upon questions submitted to it by the Executive. A special Legislation meeting of the Branch was held in March for the purpose of examining the Bill as prepared by the Advisory Conference Committee. One of the members of this committee was present at the meeting, and after a thorough explanation and discussion of its fundamental features the Bill was unaminously approved.

This report would not be complete without making further reference to the September Professional Meeting. The Committee in charge of this proved to be a diligent and well organized body who crowned their labours with a success beyond their greatest hopes. The financing of the meeting was chiefly accomplished through the suggestion and co-operation of the General Secretary who published the September number of **The Journal** as a special Niagara Peninsula Number and who allowed the Branch 50% of all special advertising secured by the members of the Branch for this issue of **The Journal.** This arrangement netted the Professional Meeting Committee some $1250 in addition to about $400 secured by subscription. The Committee turned over the Branch funds some $565 after all accounts had been settled.

The Branch membership continues to grow as is shown by the following figures:—

	1921	1920
Members	17	12
Associate Members	64	50
Associates	1	0
Juniors	14	10
Students	11	2
Affiliates	7	6
	114	80

The membership at the time of organization two years ago was 28.

Respectfully submitted,
(Signed) W. P. NEAR, M.E.I.C.,
Chairman.

REX. P. JOHNSON, A.M.E.I.C.,
Secretary-Treasurer.

FINANCIAL STATEMENT

May 13, 1920 to May 6, 1921.

Receipts.

Rebates from Headquarters on members fees, Jan. 1st. 1920 to Dec. 31. 1920	$ 154.28
Payments from the Journal for Branch News	29.73
Surplus from Professional Meeting	564.09
Affiliate's Fees	10.00
Cash on hand, May 13, 1920	3.00
Bank Account, May 13, 1920	15.49
Receipts from members for various social functions	171.45
Professional Meeting Committee for postage paid from Branch Funds	4.50
Refund from Dance Committee	39.48
	$992.02

Disbursements.

Stenography	$ 58.80
Printing	32.08
Dance Committee	200.00
Expenses for dinner meetings and entertainment	193.55
Quarters	100.00
Rubber Stamp Outfit	5.49
Incidentals re Professional Meeting	4.20
Postage stamps, long distance, telegrams, etc	64.43
Honorarium to Branch Secretary	100.00
Portion of Affiliate's fees to Headquarters for Journal	4.00
Bank Account — May 6th, 1921	229.47
	$992.02

We, the undersigned auditors, have audited the books and accounts of the Niagara Peninsula Branch of **The Engineering Institute of Canada**, and the vouchers thereof, and find the same correct.

(Signed) T. V. McCARTHY,
H. W. WAGNER,
Auditors.

Montreal Branch

J. L. Busfield, A.M.E.I.C., Secretary-Treasurer.

At a recent meeting of the Executive Committee, John T. Farmer, M.E.I.C., and H. W. Fairlie, A.M.E.I.C., were appointed Chairman and Vice-Chairman respectively of the Papers and Meetings Committee. There also were appointed S. Fortin, A.M.E.I.C., Chairman of the Civil Section; S. F. Rutherford, A.M.E.I.C., Chairman Industrial Section; C. DesBaillets, M.E.I.C., Chairman Electrical Section; F. A. Combe, M.E.I.C., Chairman Mechanical Section, and P. B. Motley, M.E.I.C., Chairman Railway Section. The above gentlemen and the vice-chairmen of the various sections yet to be appointed, form the Papers and Meetings Committee, and they are now actively engaged in preparing a programme for next season. Members of the Branch who are prepared to present papers are requested to communicate with any of the foregoing, or with the Secretary-Treasurer.

The Executive Committee has approved of the holding of a special meeting during the summer, and Messrs. Hunter, Dubuc and Busfield, were appointed a sub-committee to carry out the necessary arrangements. It is expected that preliminary announcements will be out by the time this issue of *The Journal* is in the hands of the members.

Moncton Branch

M. J. Murphy, A.M.E.I.C., Secretary-Treasurer.

The many friends of A. F. Stewart, M.E.I.C., chief engineer of the Canadian National Railways at Moncton and member of the Executive Committee of Moncton Branch, will be pleased to know that he is recovering from his recent serious operation at the Royal Victoria Hospital, Montreal.

At a meeting of the Association of Professional Engineers of the Province of New Brunswick, the resignation of W. A. Duff, M.E.I.C., Vice-President was received as he had been transferred to Toronto, and F. B. Fripp A.M.E.I.C., was appointed to the position for the remainder of the term.

A meeting of the Executive Committee was held on June 6th, and the following committees were appointed for the ensuing year.

Entertainment Committee: E. G. Evans, M.E.I.C., Chairman, R. McManus, A.M.E.I.C., J. G. Dryden, A.M.E.I.C.

Papers Committee: H. J. Crudge, A.M.E.I.C., Chairman, F. B. Tapley, M.E.I.C., F. Williams, A.M.E.I.C., J. Edington, M.E.I.C., Major C. S. G. Rogers.

Salaries Committee: J. D. McBeath, M.E.I.C., S. B. Wass, A.M.E.I.C., F. O. Condon, A.M.E.I.C.

Auditing Committee: E. R. Evans, A.M.E.I.C., K. S. Pickard, A.M.E.I.C.

Musical Director: Major Wm. A. McKee.

Cape Breton Branch

Kenneth G. Cameron, A.M.E.I.C., Secretary-Treasurer.

The first annual meeting of the youngest Branch of *The Institute* was held at Sydney, N.S., on Thursday, May 26th. The Branch members were privileged to have among them Mr. Keith, who made a special trip from Montreal for the purpose of inspecting, at first hand, the latest addition to *The Institute's* family, and of advising as to the best methods to be adopted for its successful upbringing.

The day's meeting opened at 11 a.m. in the rooms of the Mining Society of Nova Scotia, of which, by arrangement, the Cape Breton branch has the joint use. C. M. Odell, M.E.I.C., occupied the chair, and while the scrutineers were struggling with the ballot papers, called upon Mr. Keith to give the members present an informal talk upon *Institute* business.

Mr. Keith delivered to the Branch members a message of good will, and congratulation from the President and Council, and briefly, but clearly, sketched the policy which *The Institute* has adopted in encouraging the work of the Branches, and making them the prominent factor in the organization. He strongly urged the necessity of the cultivation of the social atmosphere, parallel with the technical interests, pointing out the common lack of sociability among engineers, which so often allows personal differences to stand in the way of co-operation, and professional advancement.

Mr. Keith answered various questions from members present, and, following a discussion on the influence of *The Institute* on legislation in general, the meeting adopted a motion by C. S. Creighton, J.E.I.C., seconded by A. W. McMaster, A.M.E.I.C., that C. M. Odell, M.E.I.C., D. S. Morrison, A.M.E.I.C., and K. G. Cameron, A.M.E.I.C., be appointed a legislation committee, to confer with the Halifax Branch and the Nova Scotia Mining Society, on any legislative matters affecting their common interests.

The results of the ballot for Branch officers was then announced as follows:—Chairman, C. M. Odell, M.E.I.C., acclamation. Secretary-Treasurer, — K. G. Cameron, A.M.E.I.C. Executive Committee, — for one year, — Horace Longley, M.E.I.C.; for two years, — D. S. Morrison, A.M.E.I.C., T. J. Brown, M.E.I.C., and D. F. MacIsaac, A.M.E.I.C., tied.

On a vote of those present being taken, D. F. MacIsaac was declared elected.

The Chairman then called for the report of the Secretary-Treasurer, which follows:—

Mr. Chairman and Gentlemen,

I beg to submit herewith, report covering the period of five months, since the inception of the Cape Breton Branch in January last, until this, its first annual meeting.

The formation of the Branch was the outcome of suggestions made at the Eighth General Professional Meeting at Halifax, last October. The petition to the Council of **The Institute** for the formation of the Branch was forwarded on December 20th, and carried twelve signatures.

As far as could be ascertained from records and personal enquiries there were at that time seventeen members of **The Institute** resident within twenty five miles of Sydney, — composed of five members, eight associate members, three juniors, and one student. During the period to date we have lost by transfer from this district one member and two associate members, and have gained one associate member, — so that the present Branch membership is fifteen of all grades.

This is, however, one of the largest industrial centres in Eastern Canada, and there is considerable material to draw on for membership which had to be reached. During the five months since the Branch was formed, we have received nineteen applications for membership, with a considerable number of others in immediate prospect.

In the matter of meeting the Executive Committee decided that for the time being our energies should be concentrated on increasing our membership, and that we should endeavour to arrange a good programme for the first annual meeting.

Hereafter it is hoped to hold regular meetings at least once a month, except during the summer months, when it is usual for activities to slacken. Six meetings of the Executive Committee have been held since the Branch was formed, the principal business having been the adoption of by-laws and the consideration of the various applications sent in. In connection with the by-laws, it was decided to conform to the more recent arrangements in granting voting privileges on Branch affairs to Juniors.

By arrangement with the Mining Society of Nova Scotia, we have been granted the use of their present reading rooms free of charge until such time as they remove to the new Bank of Commerce Building, after which we are to contribute $180.00 a year towards a rental of $1021.00, — an arrangement extremely advantageous to us.

With the prospect of increased membership, and the activities which should result therefrom, there should be no difficulty in meeting this obligation.

The following statement of receipts and expenditure, covers the period since the formation of the Branch to date:—

Receipts:

Jan. 28th.	Advance from Headquarters...........	$50.00	
May 25th.	Rebates for first quarter..............	6.25	
" "	Branch news for February............	.83	
	Total..................................		$57.08

Expenditure:

Postage....................................	$2.46	
Staty. and Printing........................	6.92	
Telegrams..................................	2.97	
Miscellaneous..............................	4.65	
Total................................		$17.00
Balance in hand, May 26th, 1921..........................		$40.08

Kenneth G. Cameron,
Secretary-Treasurer.

On motion by C. S. Creighton, J.E.I.C., seconded by D. F. MacIsaac, A.M.E.I.C., the report was adopted. After some minor matters were discussed, the members adjourned to Lynch's Tea Rooms for lunch.

The afternoon session opened at 3 p.m. in the Assembly Hall of the Central School, there being about seventy-five members and interested friends present, the neighbouring towns of North Sydney, Sydney Mines and Glace Bay being well represented.

Mr. Odell, in opening the meeting read an address to members and prospective members, particularly of the younger generation, emphasizing the need and advantages of such organizations as *The Institute.* This address, while partly in a lighter vein, yet carried a serious message, which those present did not fail to appreciate. Mr. Odell's address follows:—

Address by C. M. O'Dell, Chairman Cape Breton Branch, at Annual Meeting of Branch, Sidney, May 26, 1921.

There are many definitions of an engineer and the diversity of his employment has been the main trouble in forming the members of our profession into a corporation, whether a close corporation or an educational society.

The parent society — The Institution of Civil Engineers of Britain strove to define the status of a civil engineer and by exercising care in the admission of members to make a membership in the institute a standing of value without the necessity of creating a close corporation.

The Canadian Society of Civil Engineers followed along the same lines and from its creation some thirty-four years ago, it has honestly striven to elevate the profession and to make of its members, more useful members of the great fraternity which devotes its energies to the conversion of the resources of nature to the use of man.

Recently the work of the engineer had become so departmentalized that it became necessary for the Canadian Society to adapt itself to present day conditions.—We have the railway engineer, highway, marine, sanitary, electrical, mechanical, chemical and the most recent addition the forestry engineer, each devoting itself to some particular branch of engineering, but each with the same object in view, the betterment of the living conditions of the community in our immediate surroundings. As a consequence the name of our Society was rather misplaced, the existing conditions had outgrown it and in meeting present day requirements it became necessary to provide for all various branches of the profession and the name was accordingly changed to **The Engineering Institute of Canada**, the objects of which are as stated on the cover of our monthly journal.

We are used to speak of the learned professions. Up to a few short years ago there were only three professions which were classed as "learned": the doctor, the preacher and the lawyer. The doctor officiates at our entrance into this busy world, the parson does the best he knows how to ensure our safe passage into the next and the lawyer, having read of the difficulties which a rich man encounters in his efforts to attain the celestial kingdom, does his best to remove any surplus wealth which we are in danger of accumulating in our sojourn through the vale. But the people of the earth today are demanding something more definite than a chance dose of hoop–sylaricum from the doctor, the whims of a jury from the lawyer or the vagaries of some particular religious belief from the parson, and as a consequence the list of the learned professions has multiplied until its name is legion.

If the doctor mixes up the wrong decoction, carefully camouflaged under a lot of ancient heiroglyphics and your widow has to cash in your life policy, the M.D. is always there with the excuse that you were "all run down", or that you "came too late" or your system was out of order — it doesn't matter what, the result is the same, the undertaker's bill has to be paid and you're the goat. When the jury decides against you in a case which "you can't lose" according to previous advice of your solicitor, the lawyer is there with his story of miscarriage of justice, uncertainty of the jury system and a bill of costs which would make a plumber green with envy. If the parson fails in his honest endeavour, and you find that your road across the borders of the mapless land leads in a direction, opposite to that which you intended, you may try to blame it on local attraction of your magnetic needle, but while you can't come back to argue the case, you may rest assured that your spiritual advisor will not accept any of the blame for your misdirection — You're it.

The fact is that today the only certain profession is that of the engineer. If you build a bridge it must carry its load — if you lay a pipe line it must carry the water, if you build a foundation it must carry the load to be superimposed upon it, in fact there is no getting by, your work is there to answer for itself. In the language of the day you must deliver the goods and the world today is more than ever looking to the engineering profession to drag it out of the chaos with which it is threatened and by better streets, better means of transportation, better sanitary arrangements, better working conditions and better living conditions to create a more contented people, a people which when threated by danger from without will present a united front and repel the insidious attempts at disruption with which our Empire is threatened — No nation yet was ever annihilated by foes from without. Rome, Persia, Carthage, Greece, France of a century ago and Russia of today, each in turn became a world power until at last, drunk with power and indifferent to the needs of their own people, disintegration and decay set in and they became but a memory. A devotion of our best talents to the betterment of living conditions alone will obviate this and it is to the engineering profession we must look for the solution of the questions which daily present themselves.

Man is a discontented animal and always should be. The contented nation has gone to seed and it is the same with individuals. Every man should strive to leave his immediate surroundings better than he found them whether by better schools, better play grounds, better streets, better means of transportation, or better chances of self education for those who are not fortunate enough to have enjoyed a college education. In this latter connection I know of no better means than the support of such institutions as our Mining Society and our Engineering Institute. The various colleges are now specializing on the various branches of engineering and there can be no question as to the value of a college education — The lack of it, while a serious handicap, is not insurmountable. Many of our ablest engineers of the past have been self-educated and while the term "Jack plane engineer" has been applied to men who have started dragging a chain and driving stakes, it is a fact that by far the greater part of the C.P.R. from the Atlantic to the Pacific was designed, located and constructed by engineers who had come up through the stoke hold. Many engineers who have attained world wide fame and standing have completely overcome the handicap of lack of a college education. In fact if it is in a man to win, he will hardly discern the handicap. When the great Napoleon undertook the invasion of Italy, which involved the crossing of the Alps, he mapped out his whole plan of campaign to his generals, when one of them broke in with "But the Alps sire!" "There will be no Alps" Napoleon quickly replied, and so far as he was concerned there were none.

Amongst the writers of hand-books on engineering, we have not a few whose works are recognized as standards although written by men who were self-educated. Amongst these is one by a celebrated American engineer, who proclaimed on the title page that it was written by an engineer without a college education. A friend of his procured a copy and thinking to take a fall out of him wrote back and said: "We all know that you had not a college education, but who in h–ll told you that you were an engineer" — When we have made a success of our life we can cheerfully stand these little jollies.

All food comes from the soil and while our farmer friends produce it, the mere production is only one stage in the great game of supplying human wants. There is the preparation, transportation and distribution, and it falls directly upon the engineer to provide means of bringing the products from the producer to the consumer. Our agricultural colleges are doing a splendid service in the diffusion of knowledge attained by chemical analysis of the various soils and conditions and farming everywhere is being conducted on a more scientific basis.

Farming today is amply remunerative, but every man worth while is seeking something more than the elusive dollar. An interview with any of our most progressive farmers at a distance of say ten miles from the nearest town or city reveals the fact that he is far from being contented and mainly from unselfish reasons. With the country schools unable to supply the education to be had at our city schools and academies and the country district equally deficient in means of recreation and amusement, now recognized as essential to the rising generation, he sells out and comes to the city, thus increasing consumption and reducing production — This state of affairs can only be bettered by improved roads, better social surroundings, general systems of drainage and the making of the rural districts more attractive to the intelligent citizen. This is where the younger members of the engineering profession can well exert themselves. By cultivating a taste for observation, by frequent meetings at the Society's rooms for informal discussion of the various problems confronting us, by the preparation of papers on any and every subject for discussion at our regular meetings and by the interchange of ideas between various members. Engineering is essentially a young man's profession and the branches of **The Engineering Institute of Canada** are formed mainly for the benefit of the younger members of the profession — The distance to the Headquarters at Montreal, the necessary time to visit and the attendant expenses bar many a struggling young member from attendance at any of the meetings, and to bridge this, and give the rising members more benefit from a membership and a greater interest in **The Institute**, the system of branches was founded. This offers any of our younger members an education which may prove of more actual value to him than a college degree — But it can only be attained by steady application — We have only to recall the number of young men of this county who started under this handicap, but with a determination to succeed. I have in mind right now no less than three men, who started as chainmen under my own personal direction, who have reached the highest rungs of the ladder, purely through their own personal efforts.

Of men of no other profession can it be said with more truth than the engineer:—

"The heights that others won and kept
Were not attained by sudden flight
But they while their companions slept
Were toiling upward through the night."

One of the three, just now referred to, it was my pleasant duty to recommend to a $6,000.00 job with the Hydro-Electric Co., of Ontario, within the past few weeks, and in writing to the Hydro-Electric Co., I congratulated them on having secured his services, for I knew that if he devoted the same patient labour to his new position as he did to the job of educating himself, his success was assured. This man started with only such education as the country schools of Port Morien could give him, but an education is in waiting for any man who chooses to grasp it. Another case exactly similar is that of a youth who came from Morien some years ago to ask me for a job and today is in charge of large mining enterprises at Drumheller, where he is attaining wealth and reputation in keeping with his early efforts in Cape Breton.

The re-peopling of our deserted farms, the re-forestation of our destroyed forests, the reclaiming of our waste lands whether by drainage or by a study of their chemical constituents, a study of all of our natural resources and frequent discussion of the best means of producing the largest returns with the least waste, these and the production of men best qualified to handle these various problems, are the chief reasons for the formation of the Cape Breton Branch of **The**

Engineering Institute of Canada. It is up to the men who are now joining our Society to say whether success or failure shall crown our efforts.

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A. W. McMaster then read a paper on Experimental Work in Silica Brick Manufacture, describing the uses and advantages of silica brick and, the great demand for it, which had led the Dominion Iron & Steel Company to carry out, under his direction, an extensive series of experiments with local materials, resulting in the ultimate construction of a large plant for the manufacture of silica products. Mr. McMaster's paper was illustrated by slides specially prepared for the occasion.

D. S. Morrison, in following with a paper on "Magnetic Variation", apologised for its incomplete condition, and undertook to put it before the members in its completed form at an early date. The object of this paper was to show the difficulties which have arisen, and continue to arise, from the use of the magnetic north as a reference line, Cape Breton being particularly affected by the constantly changing amount of variation.

Mr. Odell then introduced Mr. Keith, who gave a valuable address on the organization, objects and policy of *The Institute*, as it stands today. Mr. Keith's address was closely followed by all present. The formation of a Branch of *The Institute* here, having created a few light ripples on the placid surface of the local engineering profession, there were many standing around the edge, curious to know the real cause of the disturbance, and Mr. Keith's explanation served to demonstrate that, instead of being the precursor of a storm, these ripples were merely the result of the activation so necessary to prevent stagnation.

Among the out-of-town members present was Mr. Geo. D. Macdougall, M.E.I.C., who, following Mr. Keith, expressed good hopes of the success and usefulness of the Cape Breton branch. He took up the matter of the absorption of the original Nova Scotia Society of Engineers into *The Institute*, and more particularly into the Halifax branch, and suggested that some of the original members had not been taken over as arranged. Mr. Keith in reply, sketched the history of the change which had been made, and the circumstances governing the transfer of members into *The Institute*. Mr. MacDougall thanked Mr. Keith for his explanation, in which he expressed entire satisfaction.

Mr. Odell, in closing the session, thanked Mr. Keith for his visit and his address, and announced that the evening meeting had unavoidably to be cancelled.

The meeting was then adjourned, gathering again for a very enjoyable dinner at 6.30.

Halifax Branch

O. S. Cox, A.M.E.I.C., Secretary-Treasurer.

The regular monthly meeting in March was held in the Tally-Ho banquet room on the evening of the 24th, and after the transaction of the business of the meeting, A. C. Brown, A.M.E.I.C., read a paper on Reinforced Concrete Fishery Piers as constructed at St. Pierre, Miquelon.

He first touched on the geographical situation, political organization and population of St. Pierre and Miquelon. With a population of about 4,000, St. Pierre is the only town, and of importance as a fishing station. A large business is carried on in fish bait and as the bait is caught during a short time each summer, a cold storage plant is being erected to store this bait during the winter as well as the fish caught off the banks. In connection with this plant, the fishery piers were erected and the construction of these structures formed the subject of the paper.

The deck is of reinforced concrete, designed to carry a live load of 500 pounds per square foot, the slabs being carried by reinforced beams which in turn were supported by concrete piers. The slabs and beams were of the usual design, the beams carrying compression steel in all cases. The supporting piers were not reinforced, the concrete being deposited within a cylindrical steel shell of ¼ inch metal and eight feet in diameter. The bottom of the harbour at that point is solid rock generally covered with boulders; these boulders were first removed but no attempt was made to level the bottom, when it was rough, the lower end of the shells was shaped with an acetylene torch to fit the harbour bottom, otherwise the shells were levelled by placing cement and sand under them by means of a diver. The shells were constructed on shore, towed to the site and sunk, then filled with concrete.

Except at the shore end, the concrete was placed with floating equipment. The mix in all cases was 1–1½–3. The coarse aggregate and sand were obtained about two miles from the work, there being a beach at that place having sand at one end and gravel at the other. Material was removed from the beach by native labour hauling it to the road in wheel barrows where teams and auto trucks hauled it to the work. About seventy men were employed, about half being natives, and all supplies, including provisions had to be brought there in vessels. In all, the completed structure required 5,500 yards of gravel, 2,000 yards of sand, 10,000 bbls. of cement and 150 tons of reinforcing steel.

During the discussion which followed, Mr. Brown told some of the many difficulties encountered in handling the work. While the outside of the steel shells was tarred to prevent rust, the concrete piers were designed to take the full load in case the shells should desintegrate.

After a vote of thanks was accorded the speaker, the meeting adjourned.

April Meeting

The April meeting of the Branch took place in the Nova Scotia Technical College, Thursday April 28th, at 8 p.m.

In the absence of the regular Chairman, the meeting was called to order by F. A. Bowman, M.E.I.C., resident Councillor.

In the absence of the Secretary, the reading of the minutes of the last meeting was dispensed with and the Chairman introduced the speaker, A. J. Barnes of the Maritime Telephone and Telegraph Co.

Mr. Barnes, whose subject was: "Some Engineering Notes on Automatic Equipment" gave a very interesting and instructive address on this phase of telephone engineering. In a brief historical sketch, he outlined the growth of the M. T. & T. Co. in Halifax, in its expansion from one to four exchanges and also the steps necessary in the location of the call areas for these exchanges. He then gave the reason leading to the installation of the "Automatic" in place of the manually operated exchange and by means of lantern slides showed the amount of engineering data necessary to collect and compute before calling for equipment tenders.

The main object of the talk, however, was a demonstration of the almost human operation of the automatic exchange which he showed very clearly by slides and by a minature automatic exchange set up in the room. At the conclusion of his remarks, Mr. Barnes demonstrated on this equipment to the satisfaction of all present.

After some discussion, a hearty vote of thanks was tendered the speaker and the meeting adjourned.

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A special meeting was held at the Technical College, Thursday, May 5th, at 8.00 p.m., with C. E. W. Dodwell, M.E.I.C., presiding.

Mr. Dodwell explained why the original date for the annual meeting had to be abandoned and asked for suggestions for another date. On motion it was decided to hold the annual meeting on Tuesday May 17th, and the Secretary was instructed to arrange for that date.

The Chairman then introduced the speaker of the evening, W. G. Chace, M.E.I.C., and one of the Vice-Presidents of *The Institute*. His subject was: "Reinforced Concrete Pipe for Water Supply".

The speaker devoted the greater part of the time to a discussion of concrete pipe as used on the aqueduct supplying the greater Winnipeg water district. Originally Winnipeg and the adjacent towns had to depend for their water supply on wells to a large extent but the water derived from that source was hard and unsatisfactory. The substitution of soft water for hard water instituted individual savings which met the interest on the cost of construction. The project was to bring soft water from an arm of The Lake of The Woods to Winnipeg, a distance of 97 miles, and the works were designed with a capacity of 85,000,000 Imperial gallons every twenty-four hours.

Owing to the low temperature in the winter and to the fact that surface water had to be excluded from the conduit, an open canal would not be practical and it was decided to lay a closed conduit for the whole distance. Except for a quarter of a mile, the whole aqueduct is of reinforced or plain concrete. For every foot of pipe laid, three feet of joint had to be made. The invert was laid in 15 foot lengths, alternate sections being put down first, and the joints between the invert sections made by a copper ribbon which projected from one section to the adjacent one and prevented water from entering the joint or escaping from it. The haunch of the invert formed the base of the arch and within the haunch was buried a wood strip, half in the invert section and half projecting into the arch; this wood strip, when acted on by the water, swelled to form a water tight joint. The arch sections were 45 feet long and the joints between these sections made by copper ribbon. The efficiency of these joints was shown by a loss of only ½ of 1% through leakage.

The geological formation of the country was touched upon to show the nature of the foundations encountered. In the muskeg district the excavation often had to be carried below grade and then a floor was built up of sand and gravel on which the invert was laid. Where the conduit paralleled the lake, the excavation was carried two feet below grade and a floor of lean concrete was built before laying the invert. For about twenty five miles Eastward from the Red River, the conduit was in the Red River clay and in this section premoulded reinforced concrete pipe was laid. Mr. Chace explained in detail the method of getting a water tight joint between the sections of this pipe which was laid in fifteen foot lengths.

The presence of salts in the ground water made it necessary to take special steps to prevent the salt solutions from attacking the concrete and converting it into a material of no strength. It was discovered that some sections already laid were being attacked by these solutions and the part of the conduit consisting of the premoulded pipe was underdrained to prevent this happening. In addition, a dense water-tight concrete gave satisfactory results. The premoulded pipe was reinforced with a double set of wire mesh, to take care of the bursting effect of internal pressure and to resist the pressure from the overburden of earth. Pipes tested showed that when the internal pressure was sufficiently strong to cause cracks, these cracks permitted the escape of water, reducing the internal pressure and the elasticity of the steel drew the concrete together and made it tight again.

Even if the joints are made tight and the pipe made strong enough to resist the bursting pressure, it does not follow that the concrete itself is water tight. Laboratory experiments were carried on for six months and a tight concrete was finally obtained by using a carefully graded mixtures which carried a proportion of stone dust and in addition a small amount of clay was added, this clay being well puddled until it had the consistency of cream. This made a fat mixture and while the pipe may not have as strong a wall as other mixtures might give, the strength was secondary to the requirement of a dense wall.

The discussion following the address brought out other points of interest and in conclusion a vote of thanks was tendered Mr. Chace. J. B. Hayes, A.M.E.I.C., and H. W. L. Doane, A.M.E.I.C., were appointed auditors for the Treasurer's report and the meeting adjourned.

Preliminary Notice

of Applications for Admission and for Transfer

20 th June 1921

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate member a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal eputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in July, 1921.

FRASER S. KEITH, Secretary.

The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

ANGUS—ROBERT W., of Toronto, Ont. Born at St. Thomas, Ont., July 24th, 1873; Educ., B.A.Sc., Univ. of Toronto, 1897; Dftman., etc., E. Leonard & Sons, London, Ont., Shoenberger Steel Co., Pittsburg, Standard Oil Co., Cleveland, Variety Iron Works, Cleveland. Design of gasoline engine, soaking pit, automatic screw machines, etc.; large number of tests on gas and gasoline engines, steam engines, high duty pumping engines, etc.; Consultant on many waterworks and similar problems and consltg. engr. in design and install'n. of such work; For over 15 years and at present, Professor of mech. engr'g., University of Toronto.

References: C. B. Hamilton, Jr., C. H. Mitchell, A. H. Harkness, R. J. Durley, P. Gillespie, T. R. Loudon.

BOOTH—MARK WESTAWAY, of Sydney, N.S. Born at Bradford, Yorks., England, March 10th, 1887; Educ., 1901-09, mech. engr'g., Chesterfield Tech. School, England; 1901-08, ap'ticed to mech. engr'g., with Sheepbridge Coal & Iron Co. Ltd., England, and 2 yrs., 1909-10, asst. blast furnace supt. with same company; 1911-21, with Dominion Iron & Steel Co. as follows:—1 yr., dfts, am., 5 yrs., chief dftsman., mech. dept., 2 yrs., gen. inspector of constrn., 6 mos., supt. of shops, and 2 yrs. to date, steam engineer.

References: D. H. McDougall, G. D. Macdougall, A. W. McMaster, K. G. Cameron, D. F. MacIsaac.

COLQUHOUN—DAVID ALFRED YEADON, of Glace Bay, N.S. Born at Halifax, N.S., June 21st, 1895; B.Sc. in mining engr'g., N.S. Tech. Coll., 1920; 1915 (summer), Can. Geol. Survey, Thetford Mines, Que.; 1916, instructor in math. Evening Tech. School, Sydney Mines; 1916-17, constrn. engr. and dftsman., Nova Scotia Steel & Coal Co.; August 1920 to date, constrn. engr., Dominion Coal Company Ltd., Glace Bay, N.S.

References: H. Longley, C. M. Odell, J. R. Morrison, D. Morrison, D. F. MacIsaac.

COSSITT—ROBERT HOFFER, of Sydney, N.S. Born at Sydney, N.S., Feb. 25th, 1888; Educ., C.E. course, I.C.S. Private tuition; 1909-11, on govt. land surveys; 1911-14, instr'man., track work, concrete foundations and gen. constrn., 1917-20, asst. to A. D. Jost, mapping, estimating, dfting, etc., and July 1920 to date, field engr's. dftsman and asst., Dominion Iron & Steel Company.

References: G. D. Macdougall, H. Longley, C. M. Odell, A. W. McMaster, K. G. Cameron.

FAIRWEATHER—STARR WHITNEY, of Montreal, Que. Born at Apahaquoi, N.B., April 30th, 1892, Educ., B.Sc., McGill University, 1916; 1911-14 engaged in various capacities by C.P.R. on Dominion Atlantic Rly. revision of line and bridge constrn., the last year in responsible charge of work; 1916, asst. engr., Dept. of Rlys. and Canals, on hbr. constrn. in maritime provinces; 1917, on Quebec Bridge; 1918-19, struct'l. engr. on staff of consltg. engr. to Dom. Govt.; 1920 to date, on Grand Trunk Arbitration.

References: R. A. C. Henry, G. G. Hare, V. I. Smart, C. N. Monsarrat, P. L. Pratley.

GAHERTY—GEOFFREY ABBOTT, of Montreal, Que. Born at Dickenson's Landing, Ont., April 3rd, 1889; Educ., Bach. of Engr'g., Dalhousie Univ., 1909. 1907 (summer), instr'man., N.S. Steel & Coal Co., Sydney Mines; 1908 (summer), dftsman., Maritime Bridge Co., New Glasgow; 1909-14, with Western Power Co. of Canada, 1909-12, as asst. engr., design of constrn. plant etc., and 1912-14, designing engr.; 1914-19, C.G.A., Halifax, Siege Artillery, France—Capt.; 1919, making surveys for Keeley Silver Mines Ltd. Winter 1920 making designs for mill for same company; At present, water power engr., also a director, Montreal Engineering Company Ltd.

References: R. F. Hayward, R. E. Chadwick, R. O. Sweezey, C. W. Allan, J. D. Calvin, F. S. Keith.

HALL—FRANCIS CHARLES, of Montreal, Que. Born at Montreal, Sept. 9th, 1883; Educ., Theory of structures, Montreal Tech. Inst., 1907; 1901-02, tracer, A. W. Robinson, consltg. engr., Montreal; 1902-04, ap'tice, 1904-06, junior dftsman., 1906-10, designing dftsman., loco. dept., Angus Shops, C.P.R.; 1910-12, mach. dftsman., Imperial Wire & Cable Co., Montreal; 1912-14 and 1918, car shop dftsman., Canada Car & Foundry Co., Fort William, Ont.; 1914-15, asst. engr., testing dept., C.P.R. Angus Shops; 1915-17, designing dftsman., high tension conduit (underground) manholes etc., Montreal Tramways Co.; 1917, dftsman., Hudson Bay Ry. Terminal, Port Nelson, Man.; 1919-20, asst. chief dftsman., air chuck dept., P. Lyall & Sons, Montreal; At present, dftsman, constrn. work, Lignite Utilization Board of Canada, Montreal.

References: A. W. Robinson, R. A. Ross, R. DeL. French, L. R. Thomson, H. H. Vaughan, D. W. McLachlan.

HAMEL—THOMAS PHILIP, of Three Rivers, Que. Born at St. Gregoire, Que., Sept. 27th, 1875; 1903-07, dftsman with following firms: Locomotive & Machine Co., Longue Pointe, C.P.R. Angus Shops, Ross & Holgate, Consltg. Engrs., Canada Car & Foundry Co., and J. A. Jamieson, grain elevator engr.; 1907-09, head designer and layout of machinery for Thomas Pringle & Sons; 1911-15, head designer and 1915-16, chief dftsman., Northern Electric Co.; 1916-18, master mechanic, Canada Stove & Foundry Co., St. Laurent; 1918-20, chief dftsman., Wayagamack Pulp & Paper Co., Three Rivers; At present, building designer, Three Rivers Pulp & Paper Co., Ltd.

References: J. J. O'Sullivan, G. M. Wynn, F. B. Brown, J. A. Jamieson, T. M. Montague.

HAY—ALEXANDER LOUDON, of Glace Bay, N.S. Born at Hamilton, Scotland, March 23rd, 1882; Educ., Prov. Tech. School, Glace Bay. 1st and 2nd class mine mgr's cert.; 1903 to date, with Dominion Coal Company as follows:—1903-04, compassman, 1904-11, transitman, 1911-20, in charge of mine surveys, 1920 in charge of ventilation of 16 collieries and at present asst. mining engr.

References: C. M. Odell, J. R. Morrison, D. Morrison, J. S. Whyte, H. Donkin.

LLOYD—MAURICE FRANK RONALD, of Magrath, Alta. Born at Calgary, Alta., July 28th, 1887; Educ., Private tuition. I.C.S. civil engr'g.; 1907 (Apr.-July), constrn., 1907 (July-Nov.) rodman on topog'y., 1908-10, rodman, 1910-11, transitman on location and constrn., C.P.R. Western Lines; 1911 to date, with C.P.R., Irrig. Br., Dept. of Natural Resources, 1911-14, asst. engr., 1914 to date Canal supt., in charge of constrn., operation & mtce. (Lethbridge Section).

References: S. G. Porter, A. S. Dawson, H. B. Muckleston, H. G. Cochrane, C. M. Arnold, G. P. F. Boese, F. S. Dyke, P. M. Sauder.

MACGILLIVRAY—JOHN ALAN, of Halifax, N.S. Born at Antigonish, N.S., June 3rd, 1881; 1895-1909, worked with following concerns:—Bridgeville Iron Mines, Mich. Iron Mines, Trenton Steel Works, Cape Breton Coal Mines & Steel Plants, and Montreal, Steel Works; 1910, G.T.P., constrn.; 1911-12, constrn. of power plant, Acadia Coal Mines; 1912-15, chief operating engr., 4000 h.p. plant, Eastern Car, 1915-16, erecting engr., 1916-17, chief operating engr., 1917-19, efficiency engr.; 1919 (May-Sept.), chief engr. in charge of install'n. of steam electric power plant under W. Rodger; 1919-21, instructor of steam engr'g., D.S.C.R.; At present assoc. editor., MacLean Publishing Co., on a group of technical papers.

References: P. A. Freeman, W. Rodger, W. G. Hardy, R. R. Murray, J. F. Lumsden.

MACKAY—CLARENCE, of Sydney, N.S. Born at New Glasgow, N.S., Jan. 4th, 1897; Educ., Short course, N.S. Tech. College, 1915; 1915-18, junior dftsman., N.S. Steel & Coal Co.; 1919-20 (6 mos.), engr'g. dept., Algoma Steel Corpn., Sault Ste Marie, Ont.; April 1920 to date, dftsman, Dominion Iron & Steel Company.

References: W. G. Matheson, D. Lewis, K. G. Cameron, R. L. Waycott, A. W. Sinnamon, D. F. MacIsaac.

MALCOLM—ALVIN LAWRENCE, of Campbellford, Ont. Born at Galt, Ont., Aug. 6th, 1884; Educ., B.A.Sc., Univ. of Toronto, 1911. 1902-06, ap'tice machinist with Goldie & McCulloch Co. Ltd., Galt, Ont.; 1909-13, with Smith Kerry & Chace, Consltg. Engrs., Toronto as follows:—1909-10, elect'l power plant design, 1911, inspection and test of high tension transmission line and electric rly. equipment; 1911-13, asst. engr. and instr'man on Healy Falls Development on Trent River; 1914 (Apr.-Aug.), Water Power Branch, Dept. of the Interior, Ottawa; 1914-16, asst. engr. on investigation of Lake of Woods Tech. Board re Lake of Woods Levels; 1916-17, supt'ing engr. on design and constrn. of Goldie Lake Dam for T.H. Low, Renfrew, Ont.; 1917 to date, res. engr. on various developments for H.E.P.C. of Ontario.

References: J. G. G. Kerry, H. G. Acres, T. H. Hogg, M. V. Sauer, A. J. Grant, E. B. Jost, N. R. Gibson.

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*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option, Railway, Municipal, Hydraulic, Mechanical, Mining or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects. Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits scientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

MARSH—KARL H., of Sydney, N.S. Born at Corydon, Pa., U.S.A., Aug. 25th, 1885; Educ., B.A., Penna. State Univ., 1909; 1909-13, mech. dftsman. with the following firms:—A. G. McKee & Co., Cleveland, Ohio, Republic Iron & Steel Co., Youngstown, Ohio, Dominion Iron & Steel Co., Sydney, N.S., Garrett-Cromwell Co., Cleveland, Ohio; 1913-18, supt. of constrn., A. G. McKee & Co., Cleveland; 1918-19, chief engr., Hamilton Furnace Co., Hamilton, Ohio; 1919-21, chief engr., Dominion Iron & Steel Co., At present chief engr., Dominion Steel Corporation.

References: A. W. McMaster, C. M. Odell, D. Morrison, G. D. Macdougall, J. R. Morrison.

McDONAH—OTTY MILTON, of North Sydney, N.S. Born at St. John, N.B., Nov. 16th, 1890; 1908-09, Dept. of Lands & Mines, N.B. Part of time, instr'man.; 1910-11, layout and struct'l. work, Geo. A. Fuller & Co., Cleveland; 1912-17, private practice, layout of water and sewerage systems, etc., Toledo, Ohio; 1917-20, field engr., By Products Coke Co. of Canada; 1920 to date, town engr., North Sydney, N.S.

References: A. Macgillivray, G. A. Bernasconi, W. C. Ewing.

PEDDER—ARTHUR GILLINGHAM, of Ottawa, Ont. Born at London, England, Oct. 22nd, 1888; Educ., 1904-08, 1st class pass, British Admiralty Mechanical Training Establishment; 1908-20, with H.M. Royal Navy as follows:—1908-11, 4th class — 1911-14, 3 rd class — 1914-17, 2nd class, and 1917-18 chief engine-room artificer. 1918-20, engineer officer. Awarded D.S.M. 1918; At present, asst. engr. in steam power house, Ottawa Electric Rly.

References: A. A. Dion, J. B. McRae, C. P. Edwards, T. C. Phillips.

PURVES—JAMES GEORGE HARRISON, of North Sydney, N.S. Born at North Sydney, July 5th, 1872; Educ., B.A.Sc., McGill Univ., 1892; Served required time for mine mgr. and under mgr. certs.; 1894-96, mgr., International Colliery; 1897-99, owner of gold mine, Forest Hill, Guysboro; 1904, with Nova Scotia Steel Co., constrn. and survey during prelim. stages and in charge of pier and haulage way, Wabana; 1905-06, in charge of constrn. Sydney Mines; 1907-08, charge of party, rly. location, Point Tupper to St. Peters. Divn. engr., on constrn. St. Peters' Rly.; On govt. staff during arbitration between Reid Company and Government, Newfoundland; 1909 to date, chief constrn. and civil engr., Nova Scotia Steel & Coal Co.

References: R. W. Leonard, R. E. Chambers, C. M. Odell, T. J. Brown, D. H. McDougall, G. D. Macdougall.

ROBERTS—HAROLD ALLEN, of Sydney, N.S. Born at London, England, May 20th, 1891; Educ., 3 yrs. evening tech. schools. 1 year N.S. Tech. College under D.S.C.R.; 1910-14, layer out at Maritime Bridge Co., Eastern Car Co. and Phodes Curry Co.; 1915-18, overseas; 1916-19, mech. dftsman., Dom. Iron & Steel Co.; 1919-20, struct'l. designer, Canada Bridge Co., Walkerville, Ont., and Detroit Edison Co., Detroit; June 1920 to date, struct'l. and mech. designer, Dom. Iron & Steel Co.

References: F. R. Faulkner, K. G. Cameron, A. W. McMaster, D. Morrison, D. F. MacIsaac.

SEARS—JOHN EDGAR, of Thorold, Ont. Born at Niagara Falls, Ont., Sept. 26th, 1886; Educ., 1906- Xmas 1910, civil engr'g., Queen's Univ.; Jan.-June 1919, Glasgow Univ. course on sea walls and English rly. practice; 1906, 4 mos. with J. H. Jackson, city engr., Niagara Falls, and 4 mos. piling insp'r., T.N.O.; 1907 (4 mos.), leveller with T. S. Fawcett, D.L.S.; 1908 (4 mos.), concrete foreman and reinforcing man, Pitt & Robinson, Toronto; 1909 (4 mos.), reinforcing and concrete insp'r., Imperial Constrn. Co., Port Arthur; 1910-11, instr'man., Hydraulic Power & Mfg. Co., Niagara Falls; 1911, concrete base structures, Shawinigan Water & Power Co., Montreal; 1912, piling insp'r. & instr'man., C.P.R., Lake Superior Divn.; 1912-16, instr'man. and asst. engr., Welland Ship Canal; 1916-19, overseas, Can. Engrs.; 1919 to date, asst. engr., Section 3, Welland Ship Canal.

References: A. J. Grant, W. H. Sullivan, F. S. Lazier, F. E. Sterns, H. M. Belfour, T. H. Hogg.

SPENCER—EDWARD SAMUEL, of Bell Island, Nfld. Born at Pilley's Island, Nfld., Jan. 2nd, 1893; Educ., I.C.S. surveying and mapping; 1909-10, asst. instr'man. with Nova Scotia Steel & Coal Co., and 1910 to date instr'man with same company, Wabana, Nfld.

References: J. B. Gilliatt, J. H. Morley, F. R. Faulkner, D. W. Burpee, C. B. Archibald, S. C. Mifflen.

STEEL—ROBERT JAMES, of St. Catharines, Ont. Born at Armagh, Ireland, Nov. 29th, 1877; Educ., City of Dublin Tech. Schools; 1893-96, in shops, Booth Bros., Engrs., Dublin; 1896-98, drawing office, Joseph Foster & Sons, Engrs., Preston, England; 1899-1900, in shops, A. & W. Smith & Co. Ltd., Eglinton Engine Works, Glasgow; 1906-12, dftsman. on constrn . asst chief engr's and chief engr's. dept., C.P.R., Winnipeg; 1912-15, dftsman., Hudson Bay Rly. office, Winnipeg; 1915-19, overseas, Lieut., C.E.F.; May 1919 to date, senior dftsman., Welland Ship Canal Office, St. Catharines.

References: W. H. Sullivan, F. E. Sterns, J. B. McAndrew, E. P. Johnson, R. C. MacLachlan.

STUART—JOHN LOWRY GIBSON, of Oshawa, Ont. Born at Toronto, Ont., in 1884; Educ., B.A.Sc., Univ. of Toronto 1910; Diploma in mining, 1907, in civil 1908, Univ. of Toronto; 1905, rodman, C.P.R.; 1906, transitman, govt. survey; 1908, insp'r., City of Toronto; 1911-12, asst. engr., Roadway dept. and rly. and bridges, City of Toronto; 1913-14, res. engr., civic rlys., Toronto; 1915-16, res. engr., Toronto-Hamilton Highway Commission; 1916-17, asst. engr., F. J. Ure, Woodstock, constrn. engr., for McRae & Compaigne, Contractors, also Blair & Co., Woodstock; 1919 to date, engr. of struct'l. material, Pedlar People Ltd.

References: W. Chipman, E. L. Cousins, F. W. Paulin, P. Gillespie, W. A. McLean, E. R. Gray, G. Hogarth.

TAIT—IRVING R., of Montreal, Que. Born at Montreal, Nov. 12th, 1891; Educ., B.Sc., McGill Univ. 1913; 2 summers on telegraph and telephone pole line constrn. etc., with C.P.R.; 1 summer elect'l repair shop; 2 years 2 mos., testing and manufacture of elect'l apparatus, Canadian Westinghouse Co. Ltd., Hamilton. One year in charge of the transformer and high tension; Six years with the Canadian Explosives Ltd. in charge of all elect'l design and layout for all plants, including power house design, also chief asst. in the mech. design of power houses, heating, ventilating systems and refrigeration layouts. At present in charge of the light, heat and power dept. of the above company, in connection with all plants.

References: J. T. Farmer, A. B. McEwen, J. W. McMahon, I. J. Tait, C. Thomson, J. M. Robertson, J. B. Woodyatt.

THEUERKAUF—ALEXANDER PAUL, of Sydney, N.S. Born at Solinger (Rheinland), Germany, Oct. 31st, 1881; Educ., B.A., Royal School of Technology, Dusseldorf, Germany; Member, Nova Scotia Mining Society; Shop practice prior to 1899 in Germany; 1899-1901, mech. dftsman., S. V. Huber & Co., Pittsburgh, Pa.; mech. dftsman, designer, checker and squad leader, Dominion Iron & Steel Co., Sydney, N.S.; 1909-10, designer with Dominion Coal Co.; 1910-11, designer and squad leader, Canada Foundry Co., Toronto, Ont.; 1911 to date, squad leader, chief dftsman. tech. engr. and asst. chief engr., Dominion Iron & Steel Co. Ltd., Sydney, N.S.

References: A. W. McMaster, C. M. Odell, D. Morrison, G. D. Macdougall, H. Longley, D. H. McDougall.

TONGE—EDWARD CLOUGH, of Sydney, N.S. Born at West Loughton, Nr. Bolton, England, Sept. 4th, 1894; Educ., B.Sc. (Tech.), Univ. of Manchester, England, 1915. City and Guilds of London Institute's exams.—1915—gas engr'g., alkali manufacture, 1919, coke and by-products manufacture; 1915-16, asst. on Bezol plant (with Messrs. Simon Carves Ltd.) in operation at Hemsworth Colliery; 1916-19 with Royal Engrs.; 1919 (May-Aug.), research work, Simon Carves Ltd., and subsequently operating gas producer in connection with coking experiments at Middleton Colliery, Nr. Leeds, England; 1919-20, asst. on heating staff of battery, coke oven dept., and June 1920 to date, testing engr. in same dept., Dominion Iron & Steel Co., Sydney, N.S.

References: K. G. Cameron, A. W. McMaster, C. M. Odell, H. Longley, D. F. MacIsaac.

WHEATLEY—EDWARD AUGUSTUS, of Vancouver, B.C. Born at Lowestoff, England, Aug. 22nd, 1885; Educ., 2 years night school, City & Guilds Tech. Coll., London, England, at same time ap'ticed to S. J. Johnson & Co. Ltd., Engineers, Stratford, E. London; for five years, 1901-05; 2nd engr's. cert., Alta., 1920. 2nd engr's. cert., B.C., 1921. Member—Assn. Prof. Engrs. of Prov. of B.C.; 1905-08, engr. to Sir Hiram Maxim and the Electric Light & Mtce. Co., office and works management; 1909-11, rly. surveying and operating rock crusher plant with C.P.R. in B.C.; 1911, 2nd engr., Edmonton Brick Co. Ltd.; 1911-14, engr. and supt., Alsip Brick Co., Edmonton, Alta.; 1914-18. overseas. Capt., Royal Engrs., Awarded M.C. and Bar; 1919-20, hospital; At present Registrar and Sec.-Treas., Assn. of Prof. Engrs. of Prov. of B.C.

References: W. G. Swan, W. Anderson, J. Muirhead, W. R. Bonnycastle, J. N. Anderson, E. G. Matheson.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

FINNIE—OSWALD STERLING, of Ottawa, Ont. Born at Arnprior, Ont., April 28th, 1876; Educ., B.Sc., McGill Univ., 1897; D.L.S. and cert. mine surveyor (by exam.); 1893-94 (summers), on constrn., Ottawa, Arnprior & Parry Sound R.R.; 1898-1909, in Dawson, Y.T. with the govt. on mining work of various kinds including mine surveying, etc., and later as mining recorder and asst. gold commr. of the Dawson District; Since 1909, inspecting engr., M.L. & Y. Branch, Dept. of the Interior, and at present inspecting engr. of mines and acting secretary Northwest Territories.

References: J. B. Challies, J. B. McRae, G. B. Dodge, J. D. Craig, M. F. Cochrane, T. H. G. Clunn.

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References: J. M. R. Fairbairn, R. W. Leonard, W. J. Francis, C. H. Mitchell, W. G. Chace, W. P. Wilgar, G. G. Gale, H. M. MacKay.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

MacGREGOR—ARTHUR EMERSON, of Toronto, Ont. Born at Toronto, Feb. 2nd 1886; Educ., B.A.Sc., Univ. of Toronto, 1912; 1905-07, survey and constrn. of Toronto & Niagara Power Co.'s transmission line; 1909, transitman on Indian Reserve surveys on Albany River; 1910-11, topog'r. (plane table) on C.P.R. Irrig. Dept. surveys and constrn., North of Bassano, Alta.; 1912-15, res. engr. in charge of storm sewer constrn., City of London, under Chipman & Power; 1915-19, overseas. Capt., 3rd Can. Res. Bn.; 1919, asst. central district (Ontario) supt., and at present engr'g. officer for Central Ontario, D.S.C.R., Toronto.

References: W. Chipman, G. H. Power, P. Gillespie, C. R. Young, J. M. Gibson, A. H. Greenlees, G. C. Hoshal, H. T. Routly.

SMYTH—CHARLES McDOWALL, of Sydney, N.S. Born at Woking, Surrey, England, April 24th, 1890; Educ., Senior Diploma and Silver Medal, London (England) Polytechnic (Elect'l. engr'g.), 1906-09; Reg'd. Prof. Engr. of the Prov. of N.S.; 1910-13, electrician Dominion Steel Corpn., Sydney; 1914, electr'n., Dominion Coal Company; 1915, night foreman, shell mfg. plant, Starr Mfg. Co., Halifax, N.S.; 1915-19, overseas, Lieut., Can. Engrs.; 1919 (Apr.-July), instructor of garage mechanics, S.C.R.D., Halifax, N.S.; 1919-21, foreman in line dept. and asst. to supt. of Light & Power, N.S. Tramways & Power Co., Halifax; Feb. 1921 to date, supt. of light & power dept., Cape Breton Electric Company Limited, Sydney.

References: I. P. MacNab, P. A. Freeman, J. B. Hayes, P. D. Mosher, O. S. Cox, R. R. Murray.

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References: H. V. Haight, A. F. Hanly, S. R. Newton, L. M. Arkley, H. C. Nourse, J. J. Traill, S. R. Turner, J. B. Stirling.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

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References: D. W. McLachlan, W. A. Bowden, C. B. Daubney, H. M. MacKay, E. Brown, J. C. Holden, P. E. Palmer, J. B. McAndrew.

MacDONALD—LESLIE STEWART, of Hamilton, Ont. Born at Peters Road, P.E.I., July 12th, 1891; Educ., B.Sc., Univ. of Alta., 1915. D.L.S. 1920; 1909-11 the International Coal & Coke Co., Coleman, Alta. and Driscoll & Knight, Edmonton, Alta.; 1912-13-14, (summers), asst. to Driscoll & Knight, in charge of parties on gen. survey work in Alta.; 1915-19, overseas. Lieut., R.A.F.; 1915 and 1919 (summers), asst. on Dominion Land Surveys; At present, dftsman., Hamilton Bridge Works Co. Ltd., Hamilton.

References: C. A. Robb, J. L. Busfield, J. A. McFarlane, J. G. Campbell.

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What about Western Coal?

The problem of extending the sales territory for western coal with suggested solutions.

R. de L. French, M.E.I.C.

Paper presented at the Tenth General Professional Meeting, Saskatoon, August 11th, 1921.

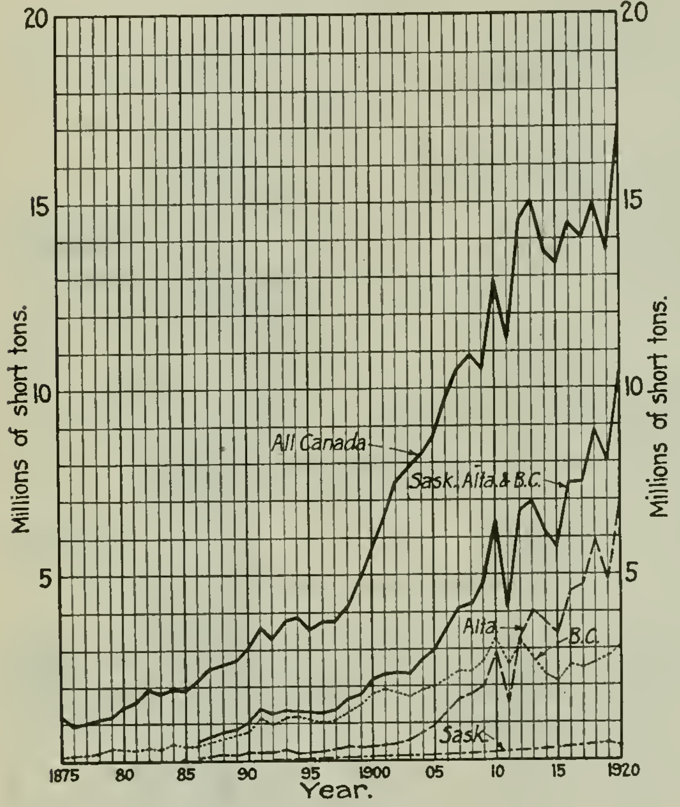
At the very beginning of this paper the writer wishes to make it perfectly clear that he is not a mining man, and that his first-hand acquaintance with Western mining conditions is limited to a slight knowledge of methods used in the Souris field of Saskatchewan. All the statements made and figures quoted are taken from sources available to anyone, and the conclusions drawn from them are believed to be only such as might be arrived at by anyone after some study of the data on which they are based. As the 1920 figures are not yet available, those for 1919 have been used, although it is realized that they do not accurately represent present conditions. However, the principles involved are the same in any case.

There is no need to discuss here the general question of Canada's coal supply and its proper utilization, although the whole matter is one of the very greatest importance. Further, it is not necessary to devote much space to British Columbia, since this province will no doubt ultimately require all her own coal for industrial and domestic purposes, for bunkering and for export, since she has been more liberally dealt with in the matter of raw materials than the plains area further east, and is strategically situated for the development of an over-seas trade, particularly with the Far East. Moreover, only one or two of the British Columbia coal fields are so located as to permit of the economical shipment of coal from them to the rest of the Dominion.

This meeting (Western Professional Meeting) is primarily interested in Alberta and Saskatchewan, and in the possibilities of exploitation offered by the vast coal resources of these two provinces. Very few people realize the great extent and value of the fields. Figures are of little use in this connection as they are so immense as to be quite without meaning. However, every Western Canadian can visualize the standard township, six miles square. All Canada's coal would cover such an area to a depth of about five and three-quarters miles. Alberta's share would be a slice of this block five miles thick, while Saskatchewan would have to be content with a mere shaving, only two-fifths of a mile thick.

Industrial Expansion in the Prairie Provinces

There are those who predict for the Prairie Provinces a brilliant industrial future. Such persons are perhaps more inspired by their desires than by their convictions. Industrial progress in this quarter will undoubtedly continue, and we trust that it will increase with the passage of time, but it seems probable that the development is likely to be local in nature, or largely based upon the use of agricultural products as raw materials, and hence limited in scope. It is unlikely that the territory between Winnipeg and the Rockies will ever possess industries commensurate with the ability of its coal resources to support them. If this view is correct, Alberta and Saskatchewan will always be exporters of coal to other provinces, and, correct or not, they will be exporters for many years to come. It behooves us, then, to hold the markets which our coal has gained, and to provide others for it as well.



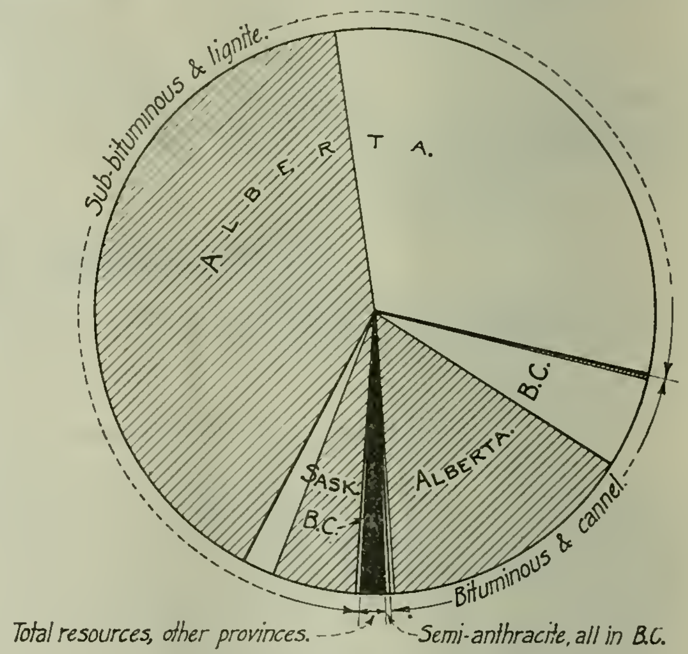
COAL PRODUCTION
IN
WESTERN PROVINCES AND IN ALL CANADA,
1875-1920.

Figure 1

Since 1914, Alberta and Saskatchewan coal has travelled further east than was previously the case, and the production has increased correspondingly. (See Figure 1) This increase in production and use has been due more to the misfortunes of the American miners of steam coal than to any concerted effort on the part of the Western producers. With the abolition of wartime restrictions and the return of something approaching pre-war conditions, we may expect a determined effort on the part of American coal to regain such of the market as it has lost for the time being. To offset this campaign, Alberta and Saskatchewan operators must make up their minds to expend a considerable sum in advertising and other promotion work. Indeed, something along this line is already being done.

Thermal Value of Prairie Coal

Unfortunately, the bulk of the coal in the Prairie Provinces is of poorer quality than is the imported coal with which it competes, being very largely lignite or lignitic. Moreover, the reserves of the better bituminous coals are hardly touched as yet. Both of these points are plainly brought out by the diagram of Figure 2. There are no Western coals which can compete in quality with American anthracite, but if the efforts of the Lignite Utilization Board are crowned with success, carbonized lignite briquettes may sometime figure as competitors.



CLASSIFICATION OF CANADA'S
COAL RESERVES.

Coal in seams 1 ft. thick or more, and 4,000 ft or less deep shown thus: ☐
Coal in seams 2 ft. thick or more, and between 4,000 ft. and 6,000 ft. deep shown thus: ▨

Figure 2

The average thermal value of Alberta coal is about 11,000 B.T.U. per pound, actual analyses showing values ranging from 13,250 down to 8,000 B.T.U. per pound. Imported American steam coal will usually run about 13,000 B.T.U. to the pound. Thus it requires about 1.2 tons of average Alberta coal to equal one ton of American steam coal in heating value. All Saskatchewan coals are poor, poorer than the worst from Alberta, and, in their raw state, can never compete with the imported product on the basis of heating value alone.

Of course, a low-grade coal at a low price may be more economical than a better one for more money. Since Western producers must of necessity sell low-grade coal in the main, they will have to sell it cheaply or not at all. Now the cost of a ton of coal is made up of two major items—the cost of production and the freight from the mine to the point of consumption. Control of the cost of production falls almost entirely within the province of mine operator, while freight rates are matters over which he has little or no control, but which are somewhat susceptible to the pressure of public opinion.

Production Features

Production conditions in Alberta and Saskatchewan are not all that might be desired, although they are perhaps as good as the average in other fields. Comparisons are difficult, and not always fair, as conditions in any two districts are quite dissimilar, yet perhaps a short discussion may indicate some directions in which changes for the better might be made.

The principal criticism which might be levelled at Western conditions is that there are too many small mines, which usually means too high overhead charges, wasteful production and uneconomical operation. The curves of Figure 3 give some indication of the state of affairs in the West in this regard as compared with those in Nova Scotia, Pennsylvania, Ohio and West Virginia, fields which are generally considered to be well and economically exploited. The comparatively small size of Alberta-Saskatchewan mines is quite apparent.

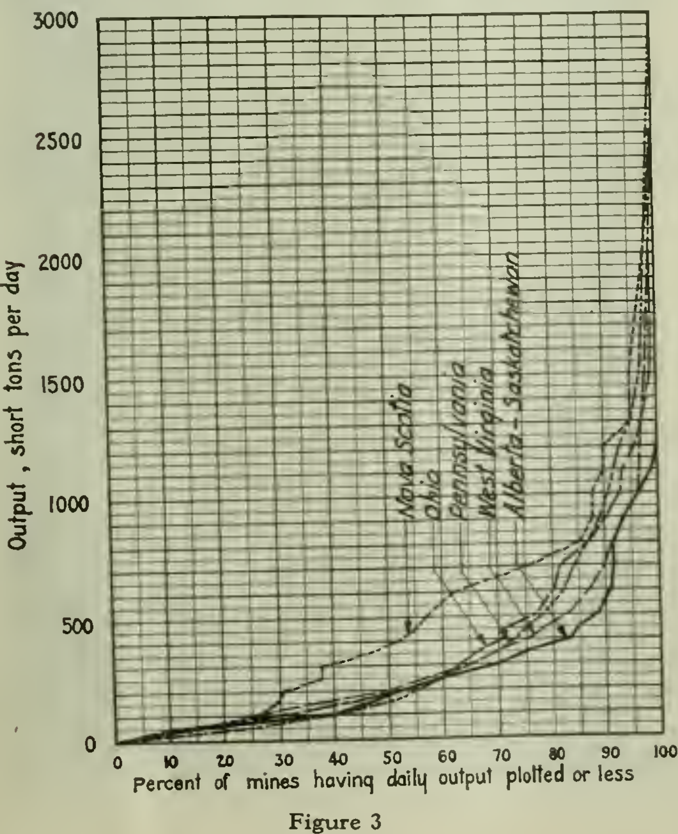


Figure 3

The larger Western mines appear to be well equipped with labour-saving machinery, and the class of man employed as a miner appears to be equal in most respects to that similarly employed elsewhere. These facts are well illustrated by the fact that the average production per man in Alberta was 660 tons, as against 450 tons in Nova Scotia, 990 tons in Pennsylvania, 1,100 tons in Ohio and 1,000 tons in West Virginia.

The continuity of production is not so high in the West as one could wish. The average number of days worked in Alberta-Saskatchewan in 1919 was only 203, as compared with 227 in Nova Scotia. Similar figures are not available to the writer for the American fields.

J. T. Stirling, Chief Inspector of Mines of the Province of Alberta, estimates that about 27% of the coal in the seam has been left in the mine without any chance of recovery during the past fifteen years. A considerable proportion of the coal raised is not marketable, this figure standing at just under 7% for 29 mines reporting in 1919. Thus there is a total loss of approximately 32% between the seam and the car.

The Cartel

As a step toward improving production conditions in the West, the writer ventures to suggest the formation of a cartel, that favorite device of the pre-war German industrialist. Even the most rabid anti-Teuton must admit that the German cartels had many good points which, if grafted upon more or less hit-or-miss organization, could not but better it.

Such an association of producers could do a good deal to make for a better atmosphere in the industry. It could:-

1. Do away with much useless and injurious competition, and wage a vigorous promotion campaign.
2. Control sales in such a way that no consumer would receive coal unfitted to his uses, and so that only high-grade coal would be sold for distant consumption, since the higher the quality the lower the freight rate per unit of heating value.
3. Shut down the small and poor mines, and arrange to compensate their owners in some equitable manner.
4. Devote time, energy and funds to the problems of raising the greatest possible quantity of coal from the seam, and of reducing outside loss to the minimum; also endeavor to find uses and a market for coal at present wasted.
5. Investigate the practicability of storing coal near large centres of consumption, so that production might be made more uniform and hence efficient.
6. Afford to improve the housing, sanitary, social, and educational conditions under which the miners are forced to live, and which are acknowledged to be now very faulty at some mines.
7. Buy in large quantities for all its members, and thus secure the lowest prices for supplies.
8. Exert a greater influence in the discussion and settlement of questions affecting the coal mining industry as a whole.

Of course, a great deal of thought would be required to work out a scheme of organization acceptable to all parties. At first sight, the large operators would probably be opposed to any such association, but it is believed that the far-sighted ones would soon be brought to realize the advantages of this proposal.

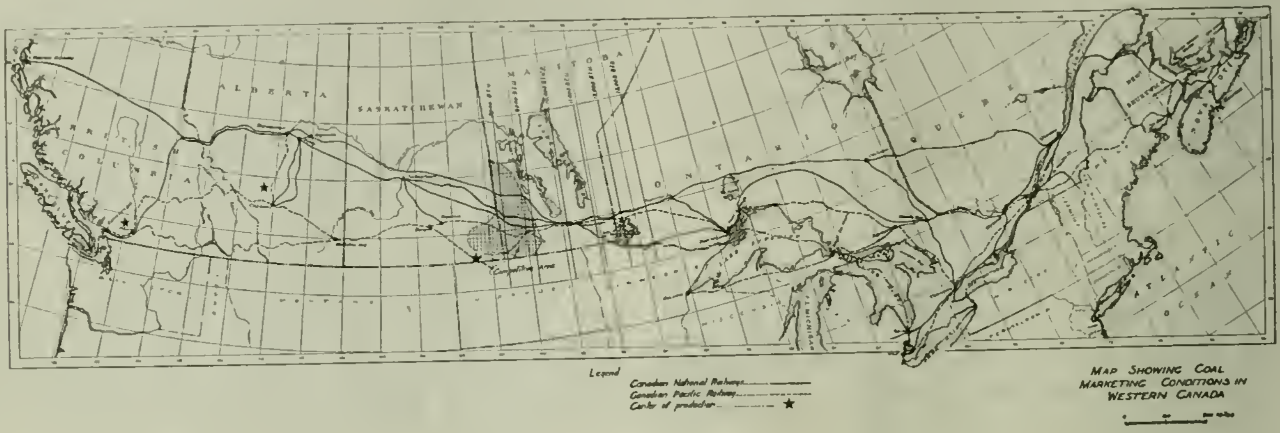


Figure 4

Two difficulties to be overcome would be those of financing and of guaranteeing that the cartel should not be used as a vehicle for profiteering. The first would not, perhaps, offer so much difficulty as seems likely at first sight. Both Dominion and Provincial Governments should be represented upon the directorate of such an organization, and might be induced to lend their financial support as well, by standing behind its securities, since they have already backed more visionary projects than this. A well-planned and conservatively managed cartel could also probably secure strong support from existing financial institutions.

As a preventive of profiteering, the consumer should be entitled to representation in some form on the governing body, as should the labour element. As a still further guarantee of fair prices, it might be arranged that at stated intervals, - say each quarter - the cartel should set its prices for the ensuing period in open hearing. Should these prices appear unreasonable, any aggrieved party might have the right of appeal to a court of competent jurisdiction for a review of the evidence upon which the prices were based. Such a right of appeal, however, should not lie without the filing of an indemnity bond for a fairly large amount, which would tend to discourage price disputes of trifling importance.

Presumably the sketchy outline of a cartel presented above will be subject to severe criticism, but, in its main features it is thought to be quite workable, and that in the end it would save the producer, and therefore the consumer, a considerable part of his present and future coal bill. Furthermore, it could offer active and powerful competition to the well-organized American coal interests and their Canadian subsidiaries, thus securing a wider use of our own coal, which is an end devoutly to be wished.

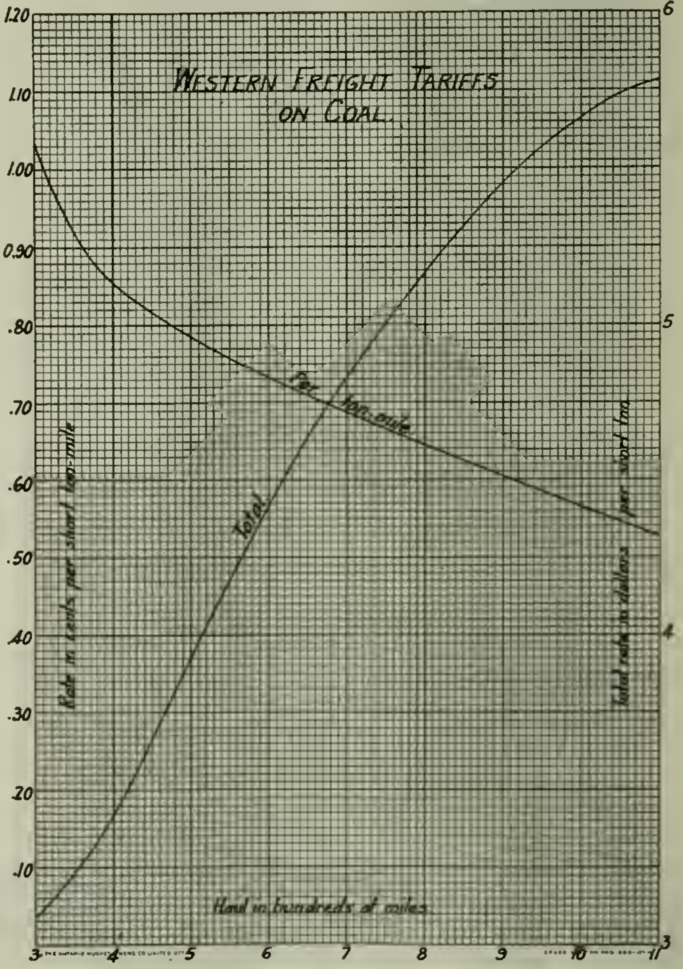


Figure 5

Transportation

Turning now to the effect of transportation costs upon the price of coal, we find the situation somewhat as shown in Figure 4. All territory west of that portion of the map marked "Competitive Area" is now supplied from Alberta-Saskatchewan, principally from the former while all territory to the east as far as Montreal is dependent upon coal from the United States.

One factor in the location of this competitive area is the freight rate. Others are the comparative quality and availability of Canadian and American coals. A study of 109 freight tariffs on coal, now in effect in the West, indicates that they may be fairly represented by the curves of Figure 5. As has already been stated, American steam coal usually runs about 13,000 B.T.U. to the pound. The centre of production in Alberta for 1919 was as indicated by the star on the map of Figure 4. Taking Alberta coal at $3.70 per short ton at this point, and American steam coal at $7.50 per short ton f. o. b. Fort William, and using the other data as stated, it is easy to work out the location of the various "contact lines" for Alberta coals of different heating values. These lines have been plotted on Figure 4, and clearly show the advantage of shipping the higher grades of coal.

Applying the same reasoning to the Souris coals of Saskatchewan, having an average B.T.U. content of 7.000 per pound and sold at an average price of $2.20 per ton at the mine during 1919, we find the "contact line" practically coincides with that of 12,000 B.T.U. Alberta coal.

It is, of course, very desirable that these "contact lines" should be pushed as far east as possible. Various methods of accomplishing this end will at once suggest themselves. The most obvious is the lowering of the freight rate. It is doubtful if much can be expected along this line, except as the rate decreases naturally, due to lower costs of carrying on the business of the railways.

Suggestions to Lower Cost of Transportation

C. V. Corless, President of the Canadian Institute of Mining and Metallurgy, has proposed that special railway equipment should be provided so that solid trains of Western coal might be made up at the mines for shipment to Eastern points, particularly to those in Ontario. According to his estimates, which are admittedly rough, it would thus be possible to compete with the imported steam coal.

Another scheme is that of getting the railways to grant materially lower rates than the standard for all coal shipped during the period of minimum east bound freight traffic, during the spring and summer months. This would require that the mines should be equipped to store a large quantity of coal during the rest of the year, or that they should operate at maximum capacity during the spring and summer, and at a much lower rate at other times. Of course, the first method is preferable.

The practicability of utilizing some of the Western rivers, notably the Saskatchewan and its tributaries, for transporting coal by barge has never been thoroughly investigated, as far as the writer is aware, but the scheme would not appear to be very attractive. For one thing, although some of these rivers tap the coal fields and are navigable for at least part of the open season in each year, they would not deliver their burdens at the points where coal is most needed. In any event the open season is short and experience with shallow river navigation elsewhere in America does not lead one to believe that it would be particularly successful from an economic point of view in Canada.

Doubtless other possible methods of lowering the cost of long-distance transportation of coal will be put forward from time to time, and ultimately a feasible one will be found. In the meantime, the fuel situation in Canada is attracting widespread attention from the general public as well as from Government, scientific, engineering and industrial bodies, which fact is a fairly good guarantee that it will finally be settled in some manner satisfactory to the country at large. If this paper shall have uncovered a single new view point of the problem as connected with the Western fields, it will have amply served its purpose.

Water Powers of the Prairie Provinces

Resources, administration and market.

C. H. Attwood, A.M.E.I.C.

Paper presented at the Tenth General Professional Meeting, Saskatoon, August 11th, 1921.

To Canada belongs the honour of being the first to generate water powers for high-tension transmission in the British Empire, a small power of 1200 h.p. having been developed on the Batiscan river and transmitted at 1100 volts to Three Rivers, Quebec, in 1895. Canada's progress from 1200 to about 1,700,000 h.p. now developed for public utility purposes in 25 years is one that any country or generation might view with pride, but great as this achievement is, it is only a part of a greater achievement, namely, the development of public utility services that has enabled this power to be usefully employed.

This development of water power comprises upwards of 90 per cent of the whole development of power for public utility purposes but it does not include power developed for direct use in various industries. The total water turbine installation in Canada amounts to 2,418,000 h.p. and when power stations now built or building are developed to full capacity this total will reach 3,400,000 h.p.

During the first ten years progress was gradual, hydro-electric engineers as such did not exist and the earlier water power stations were the joint product of civil, mechanical and electrical engineers, each bringing his particular knowledge to bear on the problem. Montreal began to receive power from Lachine in 1898. Vancouver commenced its hydro-electric career in 1903; Winnipeg two or three years later, while the utilization of Niagara Falls on the Canadian side dates from 1905. From this date progress has been steady and hydro-electric engineers capable of designing and constructing power units of 50,000 h.p. or upwards are now available.

Before the advent of electricity as an ally of water power the development of energy at water falls for saw and other mills had attained considerable importance and a number of valuable sites were sold outright, principally to the lumber interests, some of these in the older portions of the Dominion still remain undeveloped. With the enlarged scope of "white coal" its value as a national asset began to be recognized and the various governments, Federal and Provincial, realized that the sale of lands dominating power sites for their bare agricultural value could no longer be considered. For a while sites were sold by auction or at a valuation, but before long the policy of leasing sites was adopted and is at present followed in every jurisdiction throughout Canada.

Coal in Canada

In the early days when the population was small, Canada was able to supply the small needs for fuel and power by utilizing wood and importing a small amount of coal, but with the dissipation of the local supply of timber, the growth of population and the springing up of industrial undertakings, power and fuel had to be otherwise provided. The severity of the winter climate throughout a great section of the country and the extensive system of railways provide a large and growing demand for coal. Unfortunately, however, coal is only found in large quantities in Nova Scotia and New Brunswick in the East and Alberta and British Columbia in the West, so that for upwards of 2,000 miles across Canada practically no coal is found. This area sometimes spoken of as the "acute fuel area" comprises the provinces of Quebec, Ontario, Manitoba and Saskatchewan, where are situated the main industries and the bulk of the population of the country. Dependence upon the United States for coal supply in the "acute fuel area" not only constitutes a heavy drain on the finances of the Dominion but subjects a large portion of its population to any hardships that may arise owing to strikes or breakdowns in the coal industry and transportation systems of the neighbouring republic. This being the case it is only to be expected that wherever possible water would be substituted for coal as a source of power. In Central Canada this substitution alone has enabled the national prosperity to be maintained while in the remainder of the country the rising costs of fuel are making it profitable to develop power from water in preference to coal.

Alberta, Saskatchewan and Manitoba, constituting what are known as the Prairie Provinces of Canada,are particularly fortunate in that their resources include vast fuel reserves as well as important water powers. If the administration, investigation and exploitation of two resources are properly co-ordinated there need be no doubt about the fuel and power needs of the three provinces being properly met.

In Southern and Southwestern Alberta are found vast beds of anthracite, bituminous and lignite coal, while extensive lignite areas underlie Southwestern and Southern Saskatchewan. Other lignite areas are found in Southern Manitoba. Natural gas and oil also constitute sources of fuel and power, particularly in Alberta, the full extent of which cannot as yet be definitely estimated.

Water Power Resources of Prairie Provinces

While the Central-Southern portion of the Prairie Provinces is practically without water power resources, Eastern Manitoba, Western Alberta and the Northern areas of all three provinces are abundantly supplied. In Manitoba, the Winnipeg river, due to its proximity to Wnnipeg, is at present the most important power river in the province. When fully regulated, this river will have a capacity of 500,000 h.p. all within roughly 70 miles of Winnipeg, of this over 100,000 h.p. is already developed and transmitted to Winnipeg and district. Other water powers amounting to nearly 2,800,000 h.p. are to be found, principally on the Nelson, Churchill and Saskatchewan rivers.

The total power possibilities of Manitoba at known sites or drops as estimated is 3,200,000 h.p. the details of which are summarized in table No. 1.

Table No. 1,—Summary of Undeveloped Water Power in Manitoba

River	Horse Power at 80% Efficiency			Remarks
	Estimated Minimum Develop.	Estimated Maximum Develop.	Dependable with Storage	
Assiniboine	686	2,817		
Berens	11,450	18,570	13,305	
Big Black	5,140	8,339		
Bloodvein	4,100	6,660		
Burntwood	9,060	27,185	20,200	
Churchill	325,500	467,600		
Dauphin	16,960	19,540	23,450	
Fairford	2,635	3,030	3,640	
Grass	5,130	15,380		
Hayes	7,600	22,800		
Manigotagan	780	1,600	2,900	
Minnedosa	113	640		
Mossy	280	790	1,000	
Nelson	2,443,300	3,948,000		
Pigeon	24,880	40,400	28,000	
Poplar	3,885	6,285		
Red	1,060	4,400		
Saskatchewan	58,600	197,445	147,276	
Shell	20	52		
Wanipigow	400	1,100		
Waterhen	5,680	6,540	7,840	
Winnipeg	249,790	435,000	334,000	
Total	3,177,049	5,234,173		

In Saskatchewan extensive water power investigations have been made along the Saskatchewan, Churchill, Reindeer and Sturgeonweir rivers with particular reference to the Flin Flon mining district. These investigations have been supplemented by reconnaissance studies throughout the Province.

The Southern portion of the Province does not possess water power resources suitable for ready engineering development or favourable economic exploitation. The Central and Northern portions, however, are well supplied with great water power reserves. Among the more important power rivers in this section might be listed the Churchill, Reindeer and Black. Numerous important and easily developed power sites are available on these and other rivers throughout this section of Saskatchewan and development only awaits existence of a market demand and of adequate transportation facilities.

The total possibilities of Saskatchewan at known sites and drops is some 570,000 h.p. the details of which are summarized in table No. 2.

Table No. 2,—Summary of Undeveloped Water Power in Saskatchewan.

This represents the estimated total power at sites concerning which some record is available.

River	Horse-power at 80% Efficiency.			Remarks
	Estimated Minimum Development.	Estimated Maximum Development.	Dependable with Storage	
Beaver	785	2,300		
Black	72,550	217,902		
Churchill	311,150	582,415		
Foster	906	2,728		
Geikie	2,450	7,359		
Madjatik	575	1,732		
Rapid	5,927	15,750		
Reindeer	93,070	106,560		
N.Saskatchewan	3,439	14,880		
Saskatchewan	72,240	350,750		
Sturgeonweir	5,660	9,695	(1) 34,800	(1) With storage and Churchill diversion.
Total	568,761	1,312,071		

Alberta brings us once again to a coal producing province, but this has not prevented the development of approximately 33,000 h.p. principally on the Bow river to supply Calgary. Detailed power and storage investigations have been made in Alberta on the larger rivers while a great amount of data relating to the smaller streams have been collected. The largest resources are to be found in the Northern part of the Province, for of the 466,000 h.p. credited to Alberta, three-fifths is estimated as existing on the Slave, Peace, and Athabaska rivers, which offer excellent opportunities for development as soon as a market demand develops and transportation facilities become available.

As stated the total power possibilities of Alberta at known sites or drops is estimated at 466,000 h.p., the details of which are summarized in table No. 3.

Table No. 3,—Summary of Undeveloped Water Power in Alberta.

This represents the estimated total power at sites concerning which some record is available.

River	Horse power at 80% Efficiency.			Remarks
	Estimated minimum development.	Estimated maximum development.	Dependable with Storage	
Athabaska	97,795	333,550		
Bow	14,852	37,319	(1) 29,085	(1) 24 hour power.
Brazeau	2,360	7,150		
Cascade	818	1,090	1,090	
Castle	1,134	4,370		
Clearwater	3,925	11,813		
Crowsnets	276	656		
Elbow	3,400	10,580	8,640	
Oldman	478	1,820	1,270	
Peace	19,000	63,500		
Red Deer	1,616	10,130		
N.Saskatchewan	4,700	25,825	(2) 10,800	(2) 24 hour power.
Spray	1,532	3,443	7,386	
Slave	313,500	599,000		
Snake Indian (Stony)	680	2,000		
Sturgeon	68	200		
Total	466,134	1,114,446		

Table No. 4,— Summary of Developed Water Power in the Prairie Provinces.

River	Company or Owner	Location of Plant	Head in feet	Turbine or water wheel horse power installed
Bow	Calgary Power Co.	Kananaskis Falls	68	11,600
Bow	Calgary Power Co.	Horseshoe Falls	70	20,000
Bow	Calgary Water Power Co.	Calgary	10	780
Bow	Canadian Pacific Ry.	Bassano	30	135
Lake Louise Creek	Canadian Pacific Ry.	Lake Louise	115	300
Blindman	Municipality of Lacombe	Blackfalds	24	200
Winnipeg	City of Winnipeg	Point du Bois	45	67,100
Winnipeg	Winnipeg Electric Railway Co.	Pinawa Channel	40	40,000
Minnedosa	Canada Gas & Electric Corp.	Near Brandon	33	900
Minnedosa	Minnedosa Power Co.	Minnedosa	20	450
			Total	141,465

Administration

The water powers of the Prairie Provinces are administered under regulations pursuant to the Dominion water Power Act, 1919. These regulations provide for the exploitation of the water power resources under full Government control of rates, rentals, etc., in such a way as will ensure the power needs of the provinces being met to the best advantage in the public interest. The object of the regulations is to prevent unwise or premature development of water power and provide for the permanent retention in the Crown of the ownership and control of the power project. Concessions are only made for limited periods to bona fide applicants capable of prosecuting the development to a successful issue.

In the administration of the water power resources, the policy of the department is in brief: to encourage desirable development of water power resources; to discourage and prevent the initiation and development of uneconomic and wasteful projects; to ensure that each site developed shall utilize or provide for the future utilization of the maximum available power; to ensure that river systems are developed along comprehensive lines wherein each unit is a component link in a system; to ensure adequate storage measures in the interests of all powers affected; to prevent unnecessary and costly duplication of expenditures on the part of competing plants; to protect the public from inadvisable power schemes and ill designed plants and dams; to safeguard the public from monopolistic control by regulation and periodical revision of rates; to see to the early carrying into effect of agreements issued by the department for the development of power; to compel the development of existing plants to their limit when the market demands, and to the fullest conservation of the power resources of the West.

When it is realized that most of the larger streams are either interprovincial or international it becomes apparent that some of the most important features of the above policy cannot be carried out by solely provincial control. Dominion administration means protection from extra-provincial domination, it means relief from international interference, it assures continuity of fundamental investigatory effort by means of general water resource studies, hydrometric surveys, power and storage studies and appropriate research, all absolutely necessary for a proper understanding of the exceedingly complex issues involved in the best use for all purposes of water and power. It will assure the fairest and the most fearless administration and the establishment of a scheme of water power regulation as free as it is posssible to make administration, from undue political patronage or worse.

Market for Power

It is not the writer's intention to discuss at length the market for power in the three Prairie Provinces. Attention may, however, be drawn to the principal phases of the possible future demand. The steady influx of population to the cities, to the rural districts and throughout the Northern areas of the three provinces is creating a heavy and growing demand for manufactured goods and will inevitably result in a rapidly increasing demand for cheap and dependable power. The rapidly growing market for industrial products offers possibilities to municipalities in industrial lines which municipal authorities are quick to realize. Undoubtedly the industrial activity will be centered chiefly in those cities where cheap power and good transportation facilities can be obtained.

The water powers of the Winnipeg and the Bow are already utilized in considerable measure in supplying the domestic and industrial lighting and power requirements of Winnipeg and Calgary and immediately contiguous municipalities. The rapid growth of these centres offers market for constantly increasing blocks of power. The distribution of Winnipeg river power has already been extended to Portage la Prairie, Carman and Morden. Further extensions in this district will doubtless take place as the market demand warrants, while the availability of power will in itself tend to more rapidly increase the market for its use. Similar opportunities for the extension of electrical distribution from central power stations offer in other parts of the West and the future power demands of the prairies can no doubt be met by a power policy which will provide for the development of all available water powers in connection with great steam plants located at or near the mines from which they draw their fuel supplies and pour the product of the hydro and steam plants into the transmission systems for distribution. On the other hand comprehensize provincial-wide electrical transmission system designed to serve all sections irrespective of market demand cannot be economically considered under the present conditions of scattered population.

While agriculture is the great basic industry of the Prairie Provinces, they also possess unique resources of mine and forest which up to the present have been scarcely realized. The utilization of these resources with the consequent industrial centres which will be created offers a field of development which will excercise possibly as great an influence on the future of this region as has the settlement of the Prairies in the past, and which will place the prosperity of the entire territory on a broader and firmer basis. In the exploitation of these resources the water powers of the North and East will play a dominant part, ensuring as they do an inexhaustible supply of cheap power.

Already great activity is in evidence in various districts looking to the utilization of water power as an aid to the development of other natural resources. The dependable data which has been systematically secured with respect to these powers is available in the department to all interested in legitimate projects of exploitation.

In providing for the power needs of the three provinces a proper co-ordination of the water and fuel resources is essential. The provinces are fortunate in that there are vast fuel reserves available in districts where there is little or no water power. It is profitable to keep in mind that under many circumstances fuel-fired steam plants can successfully compete with hydro-electric power. In the interest of conserving these fuel resources it is however, desirable that the use of water power be encouraged wherever economically feasible. Co-ordination in the investigation and exploitation of these two resources will ensure that the fuel and power needs of the three provinces will be properly met and provided for.

The Development of Trunk Highways as Affecting the Western Provinces:

Types of highway suitable for western provinces, speed and load restrictions, methods of financing.

C. W. Dill, M.E.I.C.

Paper presented at the Tenth General Professional Meeting, Saskatoon, August 10th, 1921

The question of transportation on roads or main highways is one that has been of the utmost importance since the earliest days of settlement of our Western Provinces and, because of many reasons apparent to all those interested in our Western problems, the roads will continue to be of great importance.

In the earliest days the roads consisted of Indian Trails and these were followed by the better marked, better located and better developed Hudson's Bay Company trails and waggon roads. Many of these later trails were so well located and served settlers in such a satisfactory manner as Main traffic routes that they were surveyed, have become legal highways and still form important links in the Provincial Main roads systems.

Then came the rectangular method of surveys and the construction of the various railway lines crossing the Provinces in generally diagonal routes, the combination of which has resulted in many difficult problems to be solved in the outlining of suitable main road connections which will serve the double purpose of serving settlers in the most advantageous manner as well as acting as links in a connected provincial or inter-provincial main road system.

At a time, when the long-standing national need for more and better highways is being substantially met by large appropriations from our federal and provincial governments, one may well ask the question:—what has made this large expenditure possible and in what terms will the dividends from the investment be expressed?"

Who pays for these highways, for what purpose are they built and who benefits by them?

On our Western Prairies these questions are of peculiar interest. In the Province of Saskatchewan we have a population of about 750,000 of which about 60% reside on the farm. The rural population is spread over a tremendous area, less than 2 per square mile of land, and we have almost 210,000 miles of road allowances.

One can therefore readily realize the importance of good roads in the economic and social life of our Prairie settlers.

The universal use of motor cars, of which there are some 70,000 in this province and some 55% of which are owned by farmers, for business, pleasure and social uses, also emphasizes the great need for improved highways. This general use of the automobile has stimulated road building in a way that probably nothing else has. We are not yet so concerned with the motor truck question as, until we are able to construct roads which can with certainty be used all through the year, their use will not become sufficiently general to become a problem to be dealt with.

Sufficient public interest has been aroused to create the feeling that good roads must be built if the country is to profit to the largest extent by the economic advantages of the cheapest and best methods of transportation along our highways; and if we are to have good roads, then road financing must be placed on a sound economic basis.

Our provincial main road system as outlined comprises three classes of roads as follows:—

1. Main Highway—a road used by all or the great majority of the people of a given district and terminating at an important point such as a trading centre or elevator.

2. Inter-urban Highway—a road carrying traffic from one important point to another, located by the linking up of the main highways to each of these points.

3. Trunk Highway—a road upon which may be located a number of important points but which finally constitutes a road connecting cities or large towns.

The construction of these roads becomes a business arrangement and, under the best and most just conditions, the original investment for construction comes from the people as a whole, while the upkeep and maintenance of the roads is paid for by the vehicles that use them and in accordance with the amount of road wear each causes.

Every vehicle using the Road should pay for the road wear which it causes. This fact is fully recognized by all those concerned with legislation pertaining to highway transportation and the maintenance of roads in condition to carry this transportation.

Road Legislation

No satisfactory law has yet been framed to accomplish this end, but the Roads Bureau at Washington has been conducting tests with a view to establishing a definite and workable basis for road-conservation legislation. At the recent Good Roads Convention in Halifax this matter was discussed in the Inter-Provincial Congress of Provincial Officials and the Honourable Mr. Veniot, Minister of Public Works for New Brunswick, outlined the efforts being made in that Province to control the use of the roads at certain times in the year and under certain weather conditions. Some of these restrictions are as follows:—

1. An Act limiting the weight of loads to 3,000 lbs. exclusive of the weight of the waggon or sleigh, between March 1st to May 15th.

Special permits may be given under this Act, under bond providing for the repair or replacement of the road up to its previous condition, and there are severe penalties provided for its violation.

After considerable objection being raised by the Lumber and Mining Companies the Act has been accepted and the Government has been highly commended for it.

2. A regulation was passed in the Session of 1920-21 limiting truck loads to five tons for local trucks and to three and one half tons for outside trucks. Fees and penalties are provided in this regulation.

The annual fee for a two ton truck is $134.00 made up as follows, ($10.00 for registration + fee for carrying capacity + fee for dead weight of truck).

3. A regulation providing that no truck can use any road during heavy rains or until the roads are dry and the patrolman has gone over them and given permission.

4. A regulation refusing to permit tractors to be used in hauling loads over the roads in the spring time-while automobiles cannot use the roads, while frost is coming out of the ground. There is no definite date fixed as the restriction is regulated by local conditions and the district road supervisor determines when this restriction is to be removed.

5. A regulation restricting empty motor trucks travelling at a speed greater than 12 miles per hour.

6. No motor vehicle is allowed to use a trailer except by registration and the payment of special fees.

To those living in the West these regulations and restrictions may appear to be drastic and onerous; but, to those of us who understand the difficulties of maintaining our roads up to a useful usable standard, at all times and during all seasons, and particularly the apathy and indifference of the average person in the matter of the upkeep of the roads, these regulations contain much of merit and could well be at least partially adopted so as reasonably to control the traffic using the roads and bring people to a sense of their responsibility and obligation in the preservation of the capital invested in the roads as well as the utility of them when the weather conditions are such that all use of the roads, except in case of real necessity, should be stopped.

Uniform Traffic Regulation

Another important matter was discussed at the Halifax Convention, that of uniform traffic regulations and the Honourable John Oliver, Premier of British Columbia, advanced the following as worthy of consideration:—

1. Speed of vehicles using the roads.
2. Load limits for various types of vehicles—which brings in the question of permissible amount of loading of vehicle to each inch width of type used.
3. Interchange of travel privileges in the various Provinces, making it possible for motor truck and automobile owners to operate in other provinces than the one in which their Licence was secured, for certain periods.
4. Use of signs indicating railway crossings or some other specially dangerous local condition.

In connection with the question of "Methods of financing Good Roads, bonding, etc."—the Honourable Mr. Henry, of Tadmorden, Ontario, at Halifax, outlined the methods in vogue in the Province of Ontario.

York County had started out by issuing debentures for 30 year periods but it was found that new construction was necessary before the end of this time and the period is too long.

It is now generally felt that a 20 year period for debenture issues should be the limit as this is considered the maximum of road life even for permanent types of pavements.

For the ordinary types of earth, gravel and macadam roads, Mr. Henry advocated the pay-as-you-go system as demands will increase with the years and it is poor business to load up the future with accumulated debenture repayments.

Permanent bridges and culverts should not be included in this pay-as-you-go method. He considers that all bond issues should be for reasonably short terms and be protected by sinking funds, etc. for retirement purposes.

Following the discussion on Mr. Henry's address this resolution was passed:—

"That bonds issued for the purpose of borrowing moneys for highway construction should not be for a period longer than a conservative estimate of the permanency of the intended construction justified".

In connection with the construction of a properly outlined highway system it is evident that this should be proceeded with only after careful investigation and selection of routes, the determination of the most suitable type of construction to be used and the adherence to a definite plan so as to ensure continuity of effort and so as to obtain the best results to the publics for the money and energy expended.

Selection of Road Type

In the selection of the roads to be improved the first consideration is naturally that of service to the greatest possible number of people in the district. Following this are the questions of the natural physical conditions of the country through which the road will run and the nature of the materials available, at a reasonable cost, for the construction of the road.

The selection of the type of road to be built is the next consideration, and, in most sections of our Western Provinces, this resolves itself into a question of utility and relative cost. Naturally the question of selection carries with it a consideration of the traffic conditions and what the road is intended to stand up under. In the choice of type we must select that one which, in our best judgement, will carry the traffic that will pass over it with the least possible expense.

One difficulty we have to contend with is that, even in the United States, engineers have not yet evolved an inexpensive light type of road which will carry even ordinary farm traffic during all seasons and under all weather conditions without very serious deterioration and the need for almost constant expense for upkeep and maintenance.

Mr. Hirst, chief engineer of Wisconsin, speaking at the Good Roads Convention in Winnipeg last year said, "We have all kinds of engineers and expert advisers and people quite competent to built a standard hard-surfaced road, but we have only a small percentage of engineers who can design and built a road out of the material of the west-clay"

Types of roads are classified as earth roads, sand-clay, gravelled, macadam and concrete with or without a bituminous or other surface.

In the selection of the road to be built the two main things to be considered are,—

1. Economy of construction, not necessarily the cheapest type but to carry the traffic at the least possible expense of combined construction and maintenance charges.

2. To meet the demands of possible future development of traffic without a destruction of the whole of the capital invested in the road.

A. W. Campbell, M.E.I.C., Dominion Roads Commissioner at Ottawa, says:—

"When well-crowned, well-dragged, well-drained and well-graded, an earth road, on a proper part of a system, is just as serviceable as a paved road, if it has traffic requirements consistent with its construction.

C. H. Moorefield, senior highway engineer of public roads and rural engineering of the United States Department of Agriculture, published a schedule of what each type of road would do, for the purpose of guiding in the selection of types of roads to earn Federal Aid, and here is his summary:—

Earth Roads—will carry light volumes of all kinds of highway traffic.

Sand Clay Roads—will carry a moderate traffic of horse-drawn vehicles and light auto-traffic.

Gravel Roads—will carry heavy traffic of horse-drawn vehicles, light auto traffic and light traffic of auto trucks.

Waterbound Macadam Roads—will carry the same general class of traffic as gravel roads.

Surface-treated Macadam Roads—will carry heavy auto traffic and light traffic of heavy trucks.

Bituminous surfaced Roads—will carry heavy auto traffic and moderate traffic of heavy trucks.

Concrete Roads—will carry the same general class of traffic as bituminous roads but are capable of withstanding heavier traffic without injury.

Brick Roads—will carry the same general class of traffic as concrete.

In a paper read by A. Fraser, A.M.E.I.C., engineer, Department of Roads, Quebec, on "earth, gravel, macadam and permanent roads", he divided construction items into permanent and non-permanent.

Permanent items include alignment, grades, widening, drainage, permanent culverts and bridges and foundations, and Mr. Fraser suggested that money invested in these items should be met from capital account on moderately long re-payment periods.

Non-permanent items include surface-treatments of various kinds, maintenance, etc.

On *earth roads* all work except maintenance of surfaces and ditches can be classed as permanent.

On *gravel* or *macadam Roads* the permanent portion includes foundation and drainage work. In this connection Mr. Fraser does not recommend unnecessarily expensive preliminary drainage work but prefers to deal with each special case when the need becomes apparent.

Construction Features

In connection with the construction of roads the writer will not attempt to emphasize more than the need for constant attention to the following points:—

1. As intimate a knowledge as possible of the conditions, for a period of years, which will effect the actual location of the road and the establishment of such grades as will render the road passable for traffic at all seasons of the year

2. Very special attention to drainage, the success of which is probably five-sixths of the success of the road as a permanent means of travel.

3. The proper shaping of the road surface so as to encourage travel to spread over it rather than to follow along defined ruts, as is unfortunately so often the case and which soon renders a road dangerous for travel.

4. The placing and treatment of the surfacing material so as to give the greatest possible value in service and in the case of maintening the surface up to a satisfactory standard.

On the types of roads possible throughout the Western Provinces the question of upkeep and mainetnance is causing much more concern than the actual construction of roads. This is because of the great difficulty in awakening public opinion to a realization of the great need of preserving the capital invested as well as to the usefulness of the roads in maintaining them in a much better state of preservation.

The sparse population, the necessity of labour on the land during the short summer season and the comparative poverty of the rural municipalities, when one considers the great mileage of roads, 384 miles in each nine township municipality, to be cared for, all constitute difficulties to be overcome before the maintenance question can be given the prominence it deserves and must be given.

Road Maintenance can be defined as the act of bringing a good road *to* and holding it *in* a state of efficiency, and a maintained road is a usable road and is of unlimited value to the public.

As a result of experience in most of the States of the Union the patrol system of maintenance has been found to be much the better method and, as a means of discovering and repairing defects before they have had a chance to become serious and of avoiding annoyance and inconvenience to the travelling public, has in a new way proven the worth of the old adage that, "a stitch in time saves nine".

Northern Territory in Western Canada
Its Development and its Problems

Resources, mineral and agricultural, transportation by light railway and motor truck, financial problems

R. C. Wallace, Commissioner of Northern Manitoba

Paper presented at the Tenth General Professional Meeting, Saskatoon, August 10th, 1921

The Northern Outlook

From the close of the homesteading phase of Western development in 1913 until the present time, increasing emphasis has been placed on the value of Northern territory as an asset of present, though more particularly of future, importance to the West. There have been many reasons for this change of attitude. The insistence on the grazing possibilities of the Barren Lands by Stefansson than whom few, if any, are better qualified to speak on the subject, has directed our attention as a nation to the Far North, from which we had expected little or nothing: while the discovery of oil far down the Mackenzie Valley has more recently seized the imagination of this continent and, indeed, the English-speaking world. Within the provincial boundaries again, the Flin Flon ore-body and mining district of Northern Manitoba, the Beaver Lake territory and Lac la Ronge area in Northern Saskatchewan, the tar sands and the Smoky River coal area of Northern Alberta and the very important Stewart mining territory of Northern British Columbia, with the pulp and timber areas more particularly of Northern British Columbia, Alberta and Saskatchewan, and the immense water powers of Northern Manitoba, have had the cumulative effect of impressing on the dwellers of the Southern plains the consciousness that the industrial life of the West, when it is established, will draw its main support from Northern resources. The farmer also realizes that there are belts in the Western plains where sufficient rainfall is uncertain and harvests precarious: and that wherever agricultural land is available in the Northern bush or park lands, the rainfall is assured, and mixed farming carries few risks and considerable profit. The line of demarcation between Northern wilderness and settled territory moves rapidly Northwards and will continue to move Northwards until the farmer finds himself on the edge of the Precambrian granite, where rock exposures are numerous and soil of agricultural value limited, except in the clay belts. The policy of the railway companies — and in this respect the Canadian Northern Railway led the way — of extending their lines into Northern territory has resulted not only in an increase of population and settlement in the North, but has led as well to discoveries yet further North by the pioneers who used those railways as the starting point for their explorations.

From the geographical standpoint, the placing of emphasis on Northern territory is not only reasonable but eminently necessary. Western Canada, viewed as a strip of agricultural land between the 49th. and 54th. parallels fated to carry for all time the burden of administration of a vastly larger hinterland with a sparse population and no revenues, would make little appeal to the man of vision. When our Western territory occupies a dominant position in the British Commonwealth as it some day will, it will have attained that position not only through the wealth of the broad prairies but as well because of the varied contributions from the resources of Northern territory.

Northern Resources

A detailed statement of the resources of Northern territory — as far as known — would be out of place in this paper and may be obtained from publications by the various governments, both Federal and Provincial. There are, however some broader aspects of the situation that may be discussed here. It is generally understood that the major developments in Northern territory will be concerned with mineral resources, whether metallic or non-metallic. The Flin Flon ore-body on the boundary of Northern Manitoba and Northern Saskatchewan, will, when the copper market again reaches normal conditions, give rise to an industry in copper mining and smelting such as has already been established by the Granby interests at Anyox in Northern British Columbia and will stimulate the copper mining industry throughout the whole territory. The tar sands from the Athabaska River will form the basis of an industry of far-reaching importance when a commercial process for extracting the heavy oils has been found. The gold fields of Herb Lake, Beaver Lake, Rice Lake, Knee Lake and other Keewatin areas, will provide some camps at least of great industrial importance to the provinces, though development may come somewhat slowly because of difficulties of transportation, while in the Lac la Ronge area there are possibilities of copper. The mining population is not a stable population. The life of a camp may be given at 25 years, but during that period latent wealth, often of great value, is released, and stable population concerned with ranching, market gardening and farming follows on the heels of the mining population and takes advantage of the transportation facilities provided to the mining fields. Thus are the resources of the soil, the forest and the water powers made available through those of the mine. Our single non-renewable asset provides the starting point for the utilization of resources which with careful conservation may maintain an active population indefinitely. To take a concrete case, the operations on the Flin Flon property would maintain a population of 3000 people where at present there are only a few prospectors, would develop a minimum of 10,000 H.P. where at present no water-power is utilized, would furnish a ready market for the gardener and the truck farmer where the soil is to-day not tilled, would give the fisherman access to lakes which have not yet been tapped and would furnish power for pulp mills where the pulp industry has not yet been initiated. There is, however, a reverse side to the picture. Every centre of industrial life established in the North and every step forward in agricultural progress, leads inevitably to the elimination of fur-bearing animals and wild life. The fur industry has been the important activity of the North for two centuries and it still holds the premier place among the Northern industries. Even with the most careful conservation, however, the fur-bearing animals decrease in numbers yearly and we must squarely face the fact that as the North develops, this industry will decline to extinction; and the Indians, at present dependent to a degree on the hunt, must be weaned from their natural avocation to the white man's work if they are not to share the fate of the denizens of the woods.

Transportation and Communication

In territory where distances are great and settlement sparse, the problems of transportation and communication ever lie across the path of progress. Without reasonably cheap freight charges, development is uneconomical. Without the means of sending messages to the outside world, family life cannot be successfully maintained. The period of railway expansion in the West has passed, and for many years it will be difficult to induce the railway corporations or the government to build Northwards, except where exceptionally important industrial centres will be formed. Transportation will be provided over motor truck roads and narrow gauge light railways more extensively than in the past, and for many purposes, gold-mining camps for instance, such transportation is adequate. The onus of providing such transportation facilities will rest more heavily on the provincial governments in the future than it has done in the past, no matter whether the resources are handed over to the prairie provinces now or twenty years hence. The responsibility is provincial for the very fundamental reason that if not assumed by the provinces it will not be assumed at all. Doubtless, as far as passenger traffic is concerned, the hydroplane will to a considerable extent replace the canoe in the North. It does not seem probable, however, that the air service will be in a position to quote a freight rate for many long years that will compete with a light railway or motor truck service, except under exceptional conditions. The simplest and least costly means of communication in Northern territory will in all probability prove to be the wireless telephone. When the system has been reasonably perfected, trained operators will not be needed at outlying points where such units are established, as is the case with the wireless telegraph. With an ordinary unit operated by a 3 H.P. oil engine, the radius of transmission from 40-foot high aerials, which can be set up in a couple of hours, is seventy miles; the whole outfit can be transported in freighter canoes. There are difficulties due to "static" charges which must yet be eliminated before the system can be always relied on: and a high power wireless plant operating in the district will always make conversation impossible. Two units are being installed in Northern Manitoba territory during the present summer, which will be the forerunners, if the units prove successful, of a system will link up the important posts in that territory. From the point of view of medical services alone, apart from business and administrative requirements, such a system would prove a godsend to the pioneers who with their families are endeavouring to open up the Northern hinterland.

Aids to Development

Hitherto the efforts of governmental authorities, whether federal or provincial, have been directed more particularly to the task of evaluating such resources in Northern territory as are already known; and, on occasion, to the providing of transportation facilities such as may be needed to assist in the commercial development of the resources. Publicity work has also been organized both by the federal and provincial governments in order to place the latent assets of the West before business organizations which might be interested in securing the capital to exploit them. In our opinion, a further step must be taken in this direction: and this step it will be necessary for the provincial authorities, who are more directly interested in attracting capital to their territories, to take. What is now demanded, is not so much the description of our Northern assets in general terms, as a clear cut statement with full and accurate details, analysis of costs, revenues and general market conditions for each particular asset, whether mineral, timber or waterpower, in order that the business man may appraise the case without undue loss of time. In other works, it is the function of the provincial authorities to form the connecting link between capital and the latent wealth of the North. Signs are not wanting that the provinces have already begun to appreciate their function in this regard.

One further consideration. It is unnecessary to point out that more population is needed in the North. That will come with the exploitation of Northern wealth. It is perhaps necessary to point out that the first essential is more population in the South. To-day our provinces are being maintained by a farming population in sparsely settled prairie, whose obligations in connection with municipal enterprise and better transportation systems are such that, however sympathetic they may feel to Northern enterprise, they are apt to look askance at any considerable expeditures in Northern fields. Our farming population are keenly interested in and take no inconsiderable pride in the wealth of their provinces. We cannot but realize, however, that the North will not come fully to its own until the population of the prairies has been at least doubled and until, in place of the vacant spaces which to-day hamper the farming municipalities, the land is filled with prosperous communities whose surplus wealth will be placed at the service of the North. Those of us who have the Northern vision will do well, while we work unceasingly in the cause of the North, to give what aid we can to the efforts that are now being made to colonize the unoccupied lands of our broad prairies.

The Disintegration of Concrete in Alkali Soils.

A Summary of the results of laboratory studies together with details of the Bureau of Standards field investigations.

G. M. Williams, A.M.E.I.C., Professor of Civil Engineering—University of Saskatchewan.

Paper presented at the Tenth General Professional Meeting, Saskatoon, August 11th, 1921.

This paper is intended to be a brief review and summary of the conclusions reached by investigators who have studied the deterioration of concrete by alkali salts in the United States during the past 15 or 20 years.

As the use of concrete in the arid and semi-arid regions of the West became more extensive it was found that structures in many localities were quickly attacked and disintegrated, apparently by the salts in solution in soil water and numerous laboratory investigations were begun, first to determine whether disintegration might be correctly attributed to alkali, and second to discover some means of preventing the action. Later, the investigation was carried into the field where concrete of known quality were subjected to exposure to alkali ground waters as well as action of the elements which cannot well be duplicated in the laboratory. As a result of these, as well as similar investigations undertaken in other countries, it has been definitely determined that such deterioration of good quality concrete as has been found in alkali soils can be attributed primarily to the action of alkali salts in solution.

The Source and Distribution of Alkali in the Soil.

The weathering and breaking down of rocks by long exposure to the elements has resulted in the formation of soil, and the salts of sodium, calcium and magnesium which were once among the constituents of the rocks are now found distributed throughout the soil, usually in greatest quantities in the clay and shales. All ground waters carry in solution appreciable quantities of one or more of these salts, but it is usually in the arid regions of the West that concentrations are sufficiently high to result in such waters being classed as alkali waters. Water percolating through the soil dissolves a portion of the salts with which it comes in contact and by this means they are slowly carried away through natural drainage channels to the sea or later deposited on the surface of the ground by evaporation of the water. In the humid regions, years of heavy rainfall have resulted in the leaching of the greater portion of the soluble material from the soil, so that the ground water is now low in salt content. In the arid and semi-arid regions relatively small quantities of soluble salts have been removed except where by irrigation or other means large quantities of water have been available with good natural drainage conditions.

What is known as "white alkali" is usually a mixture of the sulphates and chlorides of sodium, calcium and magnesium, while "black alkali", so called because of its tendency to dissolve vegetation or organic matter and stain the surface of the soil a brown or black color, contains a large percentage of sodium carbonate together with smaller amounts of the white alkali. The white alkali is the most widely distributed type, and experience has shown that it is more injurious to concrte.

The Effect of Alkali Solution on Concrete.

The possibility of disintegration of concrete by alkali salts in the ground water became markedly apparent with the great development of irrigation in the Western States. The continued use of large quantities of water for irrigation has resulted in a gradual rise in the water table or soil water level in many loyalities, bringing this alkaline water in contact with the foundations and other portions of concrete structures below the surface of the the ground. This disintegration is generally first noted and is most marked, at and just above the ground line and will vary with soil water conditions. Where the alkali water level is constantly below the limits of soil capillarity, disintegration will usually be confined to that portion of the structure which is immersed for a large portion of the time, with perhaps some deterioration at the ground surface due to the occasional presence of surface water.

Disintegration at or near the surface is no doubt accelerated by frost action and alternate wetting and drying, but these effects are only contributory.

The appearance of concrete affected by alkali salts varies with the quality of the concrete, the concentration of the solution, and duration and condition of exposure. With good quality concrete of low permeability, the first stage of the action is marked by the flaking or shelling off of the surface skin of neat cement or rich mortar, exposing sand grains and aggregate particles. As the action continues larger aggregate particles are exposed and the new surface has the appearance of being abraded with white deposits of salts apparent in the pores. In the last stage the material loses its identity as concrete and appears to be a mixture of aggregate particles distributed throughout a white soft putty like lime paste. This change may be accompanied by a considerable increase in volume. If soil water conditions change so that the mass becomes dry soon after disintegration has been partially or fully completed, there will be an appreciable hardening but the strength regain is very slight as compared with that of the original concrete. Disintegration of concrete of low permeability is essentially a surface action which gradually progresses into the mass. In some cases the outer skin appears to be immune to attack but it does not entirely prevent the penetration of alkali water, which in reacting with the inner portion causes swelling which shatters the surface skin. Rapidity of penetration is dependent upon quality of concrete and concentration of salt in the water, but usually chipping away the affected portion will reveal concrete which is apparently unharmed.

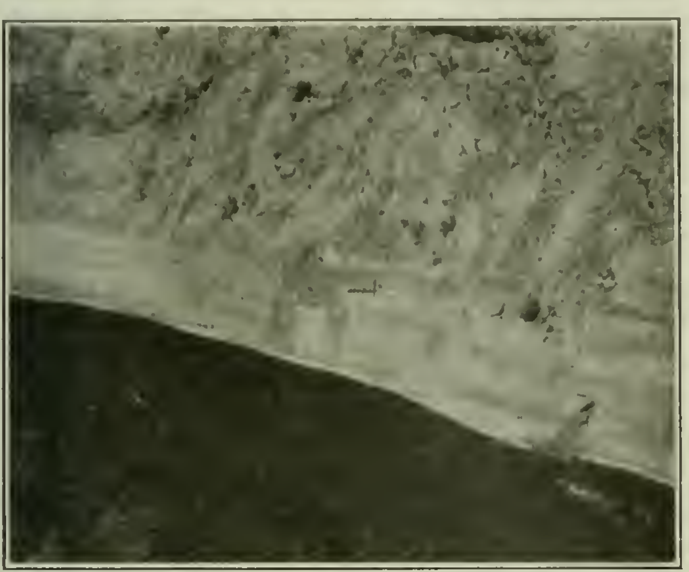


Fig. 1.—Disintegration of concrete canal lining by alkali salts in the soil water. After rains, moisture percolating through the clay and shale dissolves alkali salts which come in contact with the concrete.

A somewhat different and more rapid action occurs in the case of more permeable concrete or in mortar mixtures of the type commonly used in hand tamped drain tile and sewer pipe. The comparative ease of penetration of the alkali water through the wall exposes a large volume of cement to the action of the salts and a rapid swelling and increase of volume results, the whole mass finally breaking down to form the typical white putty like paste.

Some examples of disintegration met with in practice are shown in Figures 1 and 2. Figure 1 shows the concrete lining of an irrigation canal passing through shale which has been desintegrated by salts removed from the shale. Examination of other portions of this lining which had to be replaced showed that the entire surface in contact with the shale had been affected by alkali. The wall had been finally so weakened that it was bulged into the canal by the earth pressure. This condition can be remedied by draining seepage water away from behind the wall and taking proper care of surface water along the top. Figure 2. shows a concrete building footing which has been badly softened and disingrated by salts in the ground water. The excavation was made for the purpose of carrying the footing several feet deeper. Drainage conditions here are such that this deeper footing will probably always be immersed in ground water. Its condition in a few years can easily be imagined.

The Theory of Disintegration of Concrete by Salt Solutions.

When deterioration of concrete in alkali soils was first studied, the action was generally ascribed to the use of poor aggregates or improper methods of mixing and placing concrete and it was believed that disintegration was brought about merely by the crystallization of alkali salts in the pores of the concrete. Since the salts in crystal form occupy a greater volume than in solution it was believed that mechanical forces exerted were sufficient to disrupt the mass. This being true disintegration could be avoided by producing concrete of low permeability which would prevent appreciable quantities of salt from entering. Laboratory investigation has shown that disintegration is not due to disruptive forces exerted by salt in crystallizing, but rather to the chemical reaction between salts in solution and constituents of the cement. Disintegration is primarily due to chemical action and any disruption which may occur under certain conditions as the result of crystallization is secondary.

The constituents of the cement attacked by the salts are lime, silica and alumina. During the process of hardening of concrete calcium hydrate is formed, and it is this material which is most readily attacked. The sulphates of sodium and magnesium in alkali waters react with the calcium hydrate to form calcium sulphate and sodium and magnesium hydrates. The part played in the process of disintegration by these newly formed compounds is not well understood and probably varies with the permeability of the concrete and quantity and movement of the alkali water, but the final effect cannot be disputed since the changes produced in the laboratory under controlled conditions have been verified by the inspection of good quality concrete exposed to somewhat similar conditions in the field.

Results of Laboratory Investigations.

One of the first laboratory investigations made to study the action of alkali solutions on concrete was that of Burke and Pinkney at Montana State Agricultural College started as a result of the disintegration of concrete sewers at Great Falls, Mont. The following conclusions are outlined in their Bulletin No. 81:—

1. The disintegration of cement by alkali salts is principally due to reaction between these salts and the calcium hydroxide necessarily present in set cement. As a result of these reactions relatively insoluble new compounds are formed in the body of the cement structure.—these new compounds have greater weight and require greater space than the Ca (OH) replaced—New compounds force apart the particles of cement thus weakening or breaking the binding material.

2. A certain *weakening*, not a disruption of the cement, is due to the loss of a portion of the binding material, crystallized calcium hydroxide, which is merely dissolved and moved in solution.

3. In order for destructive action to become marked, the alkali solutions must percolate through the cement, or at least must penetrate beyond the surface.

4. Any measures that hinder the penetration of the alkali solutions into the interior of the mass will delay the destructive action.

The results of a laboratory investigation are summarized by Steik in Bulletin No. 122, University of Wyoming Experiment Station, as follows:—

1. A solution of magnesium chloride had the greatest disintegrating effect due to the action of hydrochloric acid produced by the hydrolysis of the salt.

2. The presence of sodium carbonate in solutions of the other salts retards the disintegrating effect.

3. The ultimate cause of the disintegration of cement is by the alkalies forming compounds with the elements of the cement which subsequently are removed from the cement by solution.

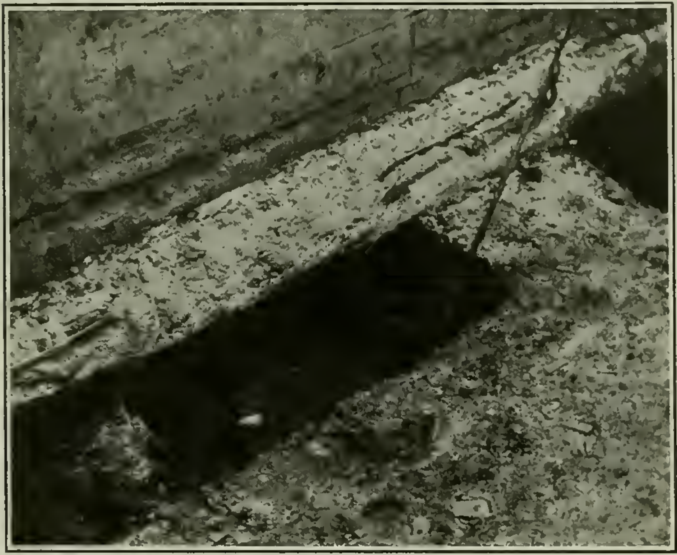


Fig. 2.—Disintegrated concrete footing of building which has been below ground water level, showing reinforcing steel exposed.

An extensive laboratory and field investigation of the action of the salts in sea water on cement was conducted by Bates, Phillips and Wig of the U.S. Bureau of Standards and reported in Technologic Paper No. 12. Since the salts used in their work are similar to those present in the ground waters of the arid regions, their conclusions are applicable to concretes exposed to alkali waters as well as sea water. Their exposure tests of various mortars and concrete were made in the sea at Atlantic City, N.J. where a laboratory was fitted up at the end of one of the piers. As a result of their laboratory investigation supplemented by exposure tests in sea water, they have drawn up the following conclusions:—

1. Portland cement, mortar or concrete, if porous can be disintegrated by mechanical means exerted by the crystallization of almost any salt in its pores, if a sufficient amount of it is permitted to accumulate and a rapid formation of crystal is brought about by drying. Porous stone, brick and other materials are disintegrated in the same manner.

2. In the presence of sea water and similar sulphate-chloride solutions:—

(a). The most soluble element in the cement is the lime. If the lime of the cement is carbonized it is practically insoluble.

(b). The quantity of lime, alumina or silica present in the cement does not affect its solubility.

(c). The magnesium present in the cement is practically inert.

(d). The quantity of SO_3 present in the cement up to 1.75% does not affect its solubility.

Bureau of Standards Field Investigation of Durability of Cement Drain Tile and Concrete Blocks.

The most extensive field investigation under way is that commenced in 1913 by the U.S. Bureau of Standards in co-operation with the Drainage Investigations of the U.S. Department of Agriculture, the Reclamation Service and the Portland Cement Association. The field work was originally outlined by an Advisory Committee representing the preceding agencies. The Committee was enlarged in 1919 by the addition of representatives from *The Engineering Institute of Canada* and the American Concrete Pipe Association.

Owing to the ultimate necessity of draining much of the irrigated land in the West it was decided to study first the durability of cement drain tile of various types and mixtures. Later, in 1915 concrete blocks were cast and installed in seeped land at various points. In order that different types of alkali waters and climatic conditions might be encountered the installations were distributed throughout the Western States as shown in Figure 3. The test specimens are located on irrigation projects of the Reclamation Service and in territory which was being studied by the Drainage Investigations Branch. The original programme provided for the manufacture of 16 varieties or types of cement drain tile, 8″ in diameter and 12″ long. To replace tile removed for test five additional types or series have since been provided at intervals. A list of all drain tile provided for test as well as essential data relating to their manufacture are included in Table 1. The tile of the original series were manufactured during the summer of 1913 at a commercial cement tile plant at Armstrong, Iowa. Good practice was followed in the manufacture of these tiles and every precaution was taken to make as good and uniform tile as the proportions of materials used would permit.

After a curing period of at least one month carload shipments were made to Garland, Wyo., Fort Shaw Mont., Huntington, Utah, Sunnyside, Wash., Yuna, Ariz., Roswell, N.Mex., Grand Junction, Colo., and Montrose, Colo. for the construction of working drains in alkali soils; to Crookston, Minn. and Columbia, Mo., for exposure to fresh water drainage and to Ames, Iowa for storage in the open exposed to the atmosphere. To replace tile removed for test in 1914, series 17 and 18 of Table No.1 were manufactured by the Universal Portland Cement Company, Chicago. Series 19 and 20 used for replacement in 1915 were manufactured by the Utah Concrete Pipe Company, Salt Lake City, Utah and in 1919 tile were furnished by the American Concrete Pipe Association.

Table I.

Schedule of Mixtures and Processes of Manufacture of Drain Tile

	Series	Proportions Cement-Sand by volume	Consistency	Manufacture	Curing	Note
Original Installation	1	1—2½	Plastic	Hand made	Sprinkling	
	2	1—2½	Quaking	do	do	
	3	1—2	Plastic	do	Steam	
	4	1—2	do	do	do	Dipped in cement grout.
	5	1—2	do	do	do	" " hot tar.
	6	1—2	do	do	do	10% ferrous sulphate in mixing water
	7	1—3	do	Packer head machine	do	
	8	1—4	do	do	do	
	9	1—1½	do	do	Sprinkling	
	10	1—1½	do	do	Steam	
	11	1—3	do	do	Sprinkling	
	12	1—4	do	do	do	
	13	1—2½	do	do	Steam	
	14	1—3	Fluid	Hand made	Sprinkling	
	15	1—3	do	do	do	Sand-Cement used
	16	1—4	Plastic	Packer head machine	Steam	From factory stock pile.
1914	17	1—1½	Quaking	On jigging Machine	Damp sand	
Replacement	18	1—2	Quaking	do	Damp sand	½" max. size aggregate
1915	19	1—2½	Plastic	Tamping machine	48 hours steam	
Replacement	20	1—2½	do	do	96 hours steam	
1919 Replacement	21	1—3	Plastic	Packer head machine	Steam	Aggregate up to ½".

*Note: Plastic consistency — Damp sand consistency. As wet as would permit immediate removal of the jacket.
Quaking consistency — Not fluid but wet enough to require retention in the moulds for several hours.
Fluid Consistency — Soupy mixture which was easily poured from a bucket.

The tile were arranged in working drains about 800 ft. long in the order shown in Figure 4 for convenience in removal for test. The replacement tile are of course grouped together similar to the "B" sections.

To determine the effect of alkali waters on mass concrete placed above and below the gound line a large number of concrete blocks were molded and installed in 1915, as listed in Table 2. These blocks are 10" square and 30" long with two steel reinforcing rods, 2" from the face with a third rod forming a loop at the top for assistance in handling. One Series "A" was moulded at Denver, Colo., a central point where an excellent quality of aggregate was available. These blocks were shipped to all projects. Another Series "B" was moulded at each project using local aggregates and cement and after curing for 30 days was set in place exposed to alkali waters. Using the same materials a third group "C" series, were moulded in position in the alkali water at each project. Blocks were installed at Orman, S.D., Garland, Wyo., Fort Shaw, Mont., Sunnyside, Wash., Fallon, Nev., Mesquite, N.Mex., Montrose, Colo., and Grand Junction, Colo.

Throughout the block work care was taken to produce the best possible quality of concrete. All materials were weighed to ensure accuracy and thoroughly

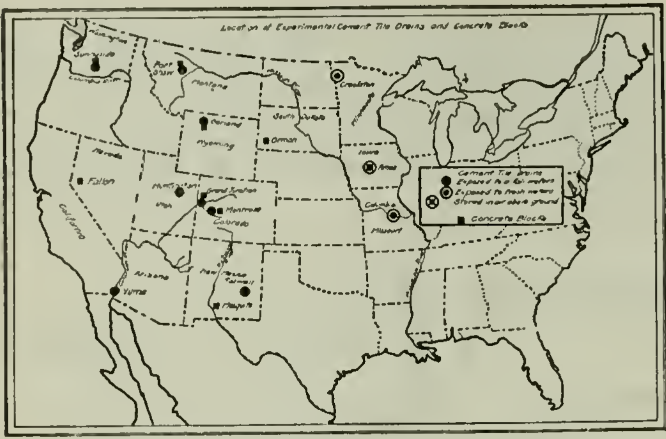


Fig. 3.—Location of projects on which cement drain tile and concrete blocks have been placed for test. Field Investigation - Bureau of Standards, 1913.

mixed by shovels in batches sufficiently large for a single block. Sufficient mixing water was used to result in a plastic quaking concrete which handled and placed easily. The consistency was not fluid as is commonly used in reinforced concrete construction and probably slightly stiffer than could be used in some types of work. Owing to the different brands of cement in use on the various projects and variation in types and physical characteristics of aggregates, a wide variety of concretes were obtained all of which are linked up in such a manner that definite conclusions can be drawn for all through the results obtained with the Denver "A" Series blocks.

Method of Field Tests and Inspections

As shown in Figure 4, the tile originally installed were so grouped that excavation of a continuous trench 32′ long would allow the removal of a section consisting of two each of the 16 types. Field tests made in 1914, 1915, 1916 and 1919 consisted of the removal of one or more such sections, and crushing tests which were made near the drain by means of the portable hydraulic tile testing machine shown in Figure 5. Samples of tile were obtained and observations made as to the condition of each, such as apparent amount of moisture and white salts in the walls. Samples of soils and waters were obtained for chemical analysis.

Concrete blocks were inspected in 1916 after one year exposure and again in 1919. This consisted of visual inspection of each block above and below the ground line. Samples of soil waters were obtained for analysis.

Chemical Analyses of Waters.

The chemical analyses of waters flowing through the cement tile drains are given in Table 3. The results shown under columns marked "I" are the average of all analyses up to and including 1916 at which time the investigation was suspended due to press of other work. The results of the analyses in 1919 are shown under column "2". These waters are all of the sulphate type with the possible exception of that at Yuma where the alkali water concentration is low. Of the bases, sodium usually predominates. Chlorine is high at Roswell, but there is also a large amount of the sulphate. Concentrations are generally below .5 of one percent and all average below .85%, although concentrations of about 5% have been found in these localities. Concentrations from year to year are quite constant with perhaps a slight tendency towards reductions might be expected after a long period of time.

The chemical analyses of soil and surface waters to which the concrete blocks have been exposed are included in Table 4. The marked differences in concentrations in the same locality may be accounted for by the fact that these pools contain more or less surface water, depending upon rainfall conditions, while the tile drains obtain their water by slow seepage through a body of soil. These waters are all of the suphate type with the exception of the Fallon, Nev. water which is high in carbonates, or "black alkali". Of these bases, sodium and magnesium predominate.

Results of Inspections and Tests

Space will not permit a detailed discussion of the results of inspections and tests but the results may be summarized as follows:—

Drain Tile

The drain tile may be ground as to consistency of mixture during moulding and method of moulding as follows:—

Group (a). Plastic Mix-machine made. Series 8 12 and 16 (proportions) (1-4); 7 and (11 1–3); 13 (1–2½); 9 and 10 (1–1½); 19 and 20 (1–2½).

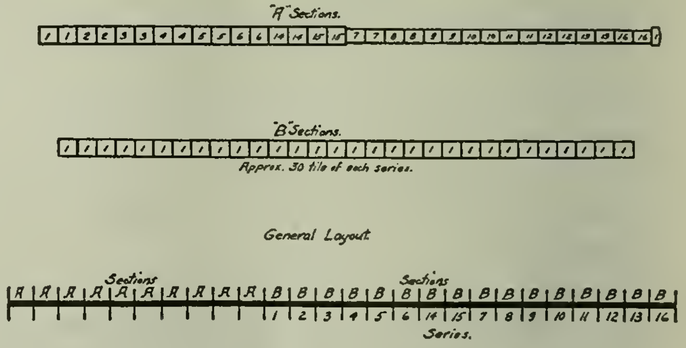


Fig. 4.—Arrangement of Cement Drain Tile. The "A" sections contain two tile of each series and were thus arranged for convenience in removal for testing. There are 10 "A" sections followed by "B" sections each of which is composed of all the remaining tile of one type.

Group (b). Plastic Mix-handtamped. Series 1 (1–2½); 3, 4, 5 and 6 (1–2).

Group (c). Quaking Mix-handtamped. Series 2 (1–2½); 17 (1–1½); and 18 (1–2).

Table II.

List of Concrete Blocks Moulded and Installed in 1915.
All blocks molded in smooth wood moulds unless otherwise indicated.
Blocks are 10" x 10" square and 30" long.

	Moulded at Denver, Colo.		Moulded at Project.			
	"A" Series Proportions by volume.		Central Yard "B" Series Proportions by volume.		In Place in Alkali Soil "C" Series Proportions by volume.	
	1–1½–3	1–2½–5	1–1½–3	1–2½–5	1–1½–3	1–2½–5
Orman, S.D.	2 [1] 2 [2] 2	2 [1] 2 [2] 2	2	2	2	2
Garland, Wyo.	2 [1] 2 [2] 2	2 [1] 2 [2] 2	2	2	2	2
Fort Shaw, Mont.	2	2	2	2	2	2
Sunnyside, Wash.	2	2	2	2	2	2
Mesquite, N. Mex.	2	2	2	2	2	2
Fallon, Nev.	2	2	2	2	2	2
Montrose, Colo.	2	2	2	2	2	2
Grand Junction, Colo. [3]	2 [1] 2 [2] 2	2 [1] 2 [2] 2	2	2	2	2

[1] Moulded in steel lined molds.

[2] Moulded in rough wood molds.

[3] Blocks of both proportions of sand-cement concrete and natural cement concrete were moulded at Denver for installation at Grand Junction.

Group (d). Fluid Mix-handtamped. Series 14 (1–3) and 15 (sand-cement 1–3).

Considering Group (a), one or more tile of each of these series has been found to contain varying qualities of salts at one or more of the projects. Tile of the proportion 1 part cement to 4 parts sand, plastic consistency (series 8, 12 and 16), have been found in this condition in all drains where exposed to alkali waters, and at five of the eight projects, swelling, cracking and partial disintegration has occurred. Tile made of one part cement to 3 parts sand (series 7 and 11), plastic consistency have been found in better condition than those of the leaner mix, although there have been cases of disintegration.

Tile of Group (b) have been found to contain salts at all projects where exposed to alkali water. Some have been badly swollen and cracked. These tile show the inefficiency of hard tamping and the high permeability which is characteristic of dry consistencies. No beneficial effects have resulted from the addition of ferrous sulphate to the mixing water of the tile of Series 6 or by a coating of neat cement grout, or the tar coating of Series 5, although the latter has acted as a retarder where concentrations were low. Tar seemed to have little beneficial effect in the higher concentrations.

The tile of wetter consistencies in groups (c) and (d) have generally shown themselves to be superior to (a) and (b). Series 19 and 20, 1915 replacement tile have shown themselves to be as resistant as the (c) and (d) groups. These two series were made on a machine of the tamper type which apparently produces a tile of lower permeability. Of the two latter groups, Series 15 have been found badly affected in several of the drains. These tile are not fully comparable since the cement content is only one half that of a normal 1-3 mix. Series 17 and 18 both high in cement content and of quaking consistency have been found affected in the drains at Montrose, Colo. and Roswell, N.Mex. These tile have a very low permeability and the disintegration is typical of the action on the best quality concrete, beginning just within the outer surface and progressing into the wall. Series 2 and 14 have been the most resistant of all tile used. Tile of Series 14 were found affected at Montrose, Colo. and Grand Junction, Colo., in 1916. Until 1919 none of Series 2 had shown the effects of alkali, but at this time a number were removed from the upper end of the drain at Montrose, lying in shale, and several were found to be damaged on the ends. No doubt these particular tile were exposed to much higher concentrations of seepage water which found entry to the drain at this point than was apparent from the result of analysis of the water sample from the outlet of the drain.

In summarizing the condition of the drain tile it may be said that rich mixtues of quaking consistency have proven to be most resistant to disintegration but that even the best mixtures as represented by Series 2, 14, 17 and 18 may be affected under certain conditions, probably most dependent upon concentration of salts in the seepage water.

In Figure 6 are shown portions of tile of Series 14,17 and 18 which have been found disintegrated.

Table III.

Analyses (Percentage Reacting Values) of Waters in Experimental Drains.

1. Average results of analyses including 1916 inspection.
2. Analyses of samples taken in 1919.

Samples taken at outlet.

Location	Percent Soluble Solids in Water		Percentage Reacting Values											
			Na		Ca		Mg		Cl		SO^4		CO^3	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Garland, Wyo.	.33	.20	32.0	33.2	10.3	9.8	7.7	7.0	3.2	1.8	40.6	36.6	6.2	11.6
Fort Shaw, Mont.	.20	.12	30.6	29.0	6.6	7.4	12.8	13.6	1.6	.7	34.2	25.2	14.2	24.1
Sunnyside, Wash.	.40	.24	24.7	20.4	14.0	17.8	11.3	11.8	6.1	6.3	38.1	37.0	5.8	6.7
Yuma, Arizona	.11	.11	23.5	26.3	16.3	12.9	10.2	10.8	15.4	14.2	12.9	17.4	21.7	18.4
Roswell,N. Mex.	.46	.49	23.9	25.4	19.4	18.5	6.7	6.1	27.1	28.1	20.0	19.0	2.9	2.9
Montrose, Colo.	.50	.23	9.2	.8	15.8	40.6	25.0	8.6	.5	..	46.0	46.3	3.5	3.7
Grand Junction, Colo.	.85[1]	.33[2]	25.9	25.5	10.1	11.3	14.0	13.2	17.7	16.2	28.7	25.1	1.9	3.5
Huntington, Utah	.30	no flow	18.3	....	20.1	....	11.6	....	1.8	....	40.8	....	7.4	....

1. 1.7% nitrates.
2. 5.2% nitrates. Concentration unusually low, probably because of flooding of drains of adjacent tract during irrigation at time sample was taken.

Concrete Blocks

The condition of the concrete blocks after four years exposure to alkali waters is best measured and expressed by the salt concentrations which have been found in the different localities. At Fallon, Nev. where concentrations have been low all concrete is apparently unaffected. At Orman, S.D. where concentrations have been high practically all blocks except 1-1½-3 proportion Denver blocks have shown signs of disintegration. At Mesquite, N.Mex. where concentrations have also been high all blocks are badly disintegrated and cracked. In general the Denver blocks are in better condition than blocks molded on the projects. At three projects blocks moulded in metal lined, planed wood and rough wood forms were installed for comparison. Results indicate no choice among these three surfaces. The "B" and "C" Series blocks permit a comparison to be made between concrete cured 30 days before exposure with blocks which are moulded in place in the soil and water. There is little choice, but the "C" Series molded in place are generally in a better condition. Blocks exposed to the intermediate concentrations as at Garland, Wyo. do not show marked signs of disintegration, but the effect of the alkali is evidenced by the shelling and scaling off of surfaces, at an above the water line, especially on the 1-2½-5 mixtures. Blocks made of natural cement and installed at Grand Junction, Colo. were completely disintegrated during the first winter's exposure. Freezing and thawing no doubt accelerated this action.

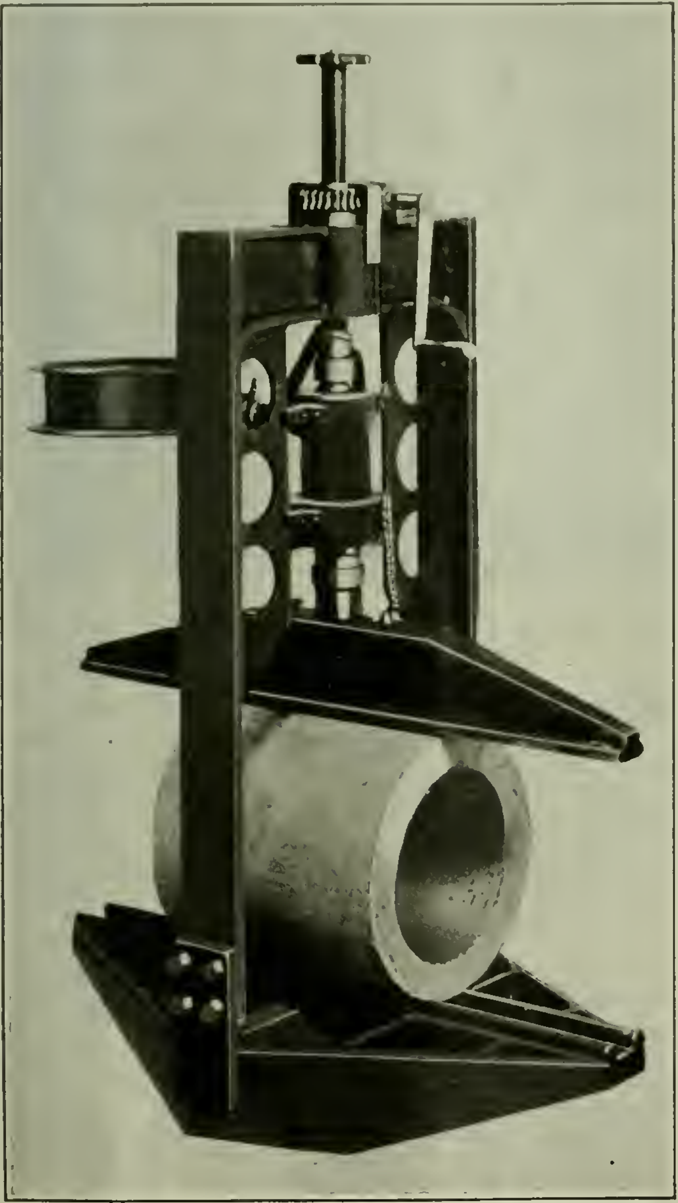


Fig. 5.—Portable drain tile testing machine used in making crushing tests of tile removed from the drains. Entire machine with the exception of the gears and the hydraulic gauge is made of cast aluminum. For shipment the machine is dismantled and packed in a steamer trunk.

In Figure 7 is shown a 1-2½-5 proportion block which has had its surfaces shelled off. Inspection of this block in 1916 revealed that no disintegration had occurred except that the neat cement surface had been shelled off exposing fine aggregate grains. This action progressed during the three following years being most marked at the ground line but also apparent below the ground surface.

In Figure 8 are shown a portion of the blocks installed at Mesquite, N.Mex. All blocks here, including the Denver "A" Series, are badly affected, being cracked and swollen so that complete disintegration is only a matter of time.

Conclusions.

Consideration of the number of laboratory studies which have been made and the extent of the field work which has included all qualities of concretes and mortars exposed to a wide variety of conditions would seem to justify certain conclusions as to the affect of soluble salts on concrete.

1. Laboratory studies agree that disintegration is primarily due to reaction between the salts in solution and certain constituents of the cement. Disintegration is first a chemical action which may under some conditions be accelerated by crystallization of the resulting products as well as by alternate wetting and drying and the action of the elements.

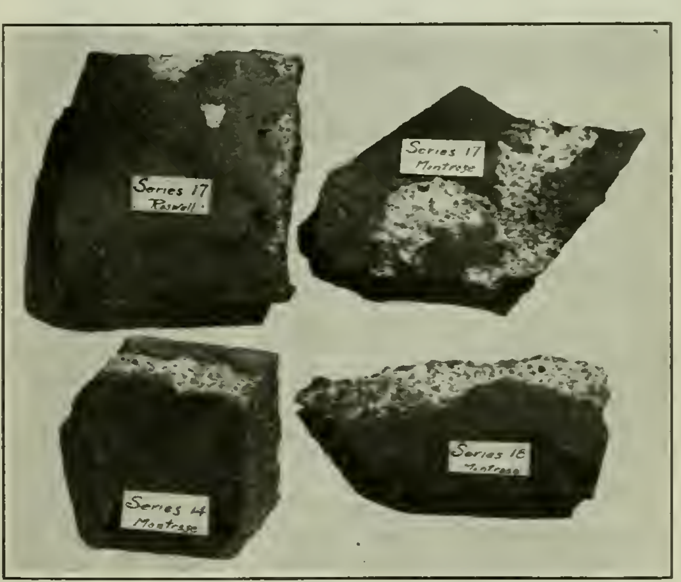


Fig. 6.—Disintegrated tile of Series 14, 17, and 18 removed from the drains at Montrose Colo., and Roswell, N. Mex., in 1916. These are rich mixtures of low permeability and illustrate the manner in which the best quality of concrete is disintegrated.

Table IV

Analyses of Surface and Subsoil Waters at Block Sites.
1915 to 1919

Location	Date	Percent Soluble Solids in Water	Percentage Reacting Values					
			Na	Ca	Mg	Cl	SO^4	CO^3
Orman, S.D.	Fall 1915	1.46	24.7	3.5	21.8	.6	47.9	1.5
	Spring 1916	.93	22.8	9.3	17.9	.1	45.4	4.5
	Fall 1916	1.36	23.7	21.8	4.5	.5	47.2	2.3
	Fall 1919							
Surface water at site		3.31	18.3	9.4	22.3	.4	46.6	3.0
Subsoil water above site		.51	10.5	15.4	24.1	.2	45.9	3.9
From pond below site		.93	18.3	9.4	22.3	.4	46.6	3.0
Garland, Wyo.	Fall 1915	.81	42.5	4.2	3.3	3.3	41.9	4.8
	Spring 1916	.70	41.8	4.0	4.2	3.3	41.5	5.2
	Fall 1916	.67	41.4	4.2	4.4	3.9	39.5	6.6
	Fall 1919	.41	43.1	3.3	3.6	3.2	38.2	8.6
Fort Shaw, Mont.	Fall 1915	.40	36.5	2.4	11.1	2.0	47.3	.7
	Spring 1916	.95	33.0	6.7	10.3	1.7	47.0	1.3
	Fall 1916	2.44	34.7	2.7	12.6	1.3	47.7	1.0
	Fall 1919	1.67	32.0	4.7	13.3	2.0	46.3	1.6
Sunnyside Wash.	Fall 1915	.22	19.7	13.9	16.4	8.5	36.9	4.6
	Spring 1916	.22	29.2	7.0	13.8	6.2	41.1	2.7
	Fall 1916	.22	26.6	6.9	16.5	8.3	47.3	4.4
	Fall 1919	.23	29.2	6.6	14.2	8.9	35.1	6.0
Fallon, Nev.	Fall 1915	.13	44.8	2.4	2.8	9.0	22.7	18.3
	Spring 1916	.13	46.7	2.1	1.2	8.5	21.2	20.3
	Fall 1916	.12	46.4	2.7	.9	9.6	22.1	18.3
	Fall 1919	.10	44.9	2.7	2.4	8.5	21.2	20.3
Mesquite, N.Mex.	Fall 1915	.86	43.2	5.5	1.3	21.7	29.4	.90
	Spring 1916	3.02	43.4	3.7	2.9	14.8	34.6	0.60
	Fall 1916	2.64	42.8	4.0	3.2	23.5	25.8	0.70
	Fall 1919	.47	39.4	7.0	3.6	13.0	36.1	0.90
Montrose, Colo	Fall 1915	1.61	30.3	4.4	15.3	.7	48.0	1.3
	Spring 1916	1.09	29.5	6.9	13.6	.7	47.0	2.3
	Fall 1916	1.78	28.4	5.6	16.0	.7	48.6	0.7
	Fall 1919	.65	16.4	17.4	16.2	.4	48.5	1.1
Grand Junction, Colo.	Spring 1916	2.51	39.3	3.2	7.5	2.2	47.2	.6
	Fall 1916	.32	30.6	16.6	2.8	.8	47.6	1.6
	Fall 1919	1.02	45.6	7.3	7.2	1.1	47.5	.9

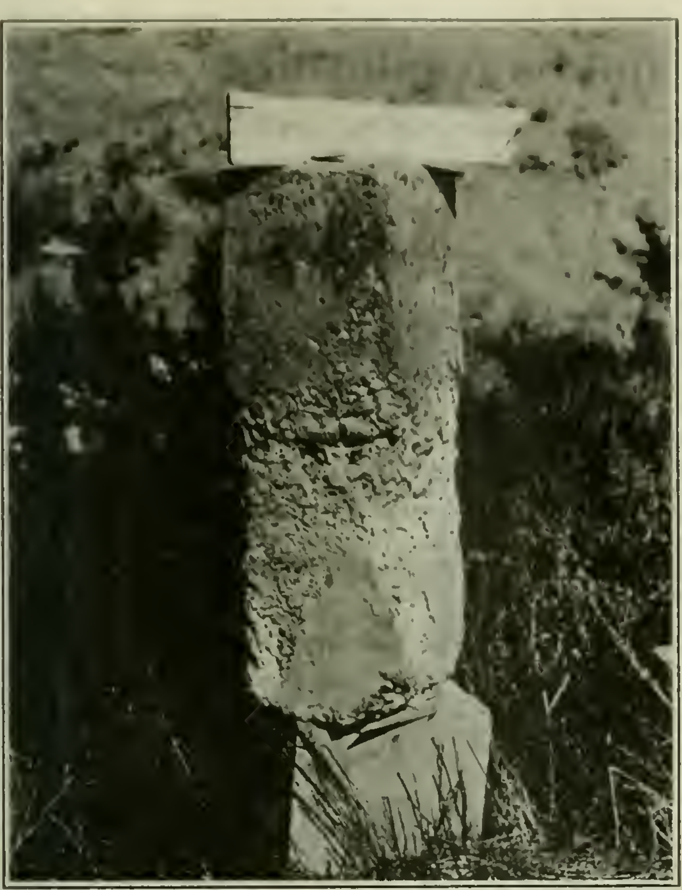


Fig. 7.—Concrete block of 1—2½—5 proportion after 4 years exposure at Montrose Colo. Disintegration is most apparent at the ground line.

2. Field investigations verify the above conclusion and a study of conditions indicate that the rate of disintegration is dependent upon concentration of salt solutions characteristic of the concrete and exposure conditions. Sulphates appear to be most injurious, chlorides and carbonates are also usually present but their affect on the reactions cannot be definitely determined from the data available.

3. Concrete of the highest quality, based upon present standards, have been seriously affected in high concentrations of sulphate waters.

4. Concentrations of salts in soil water vary so greatly only short distances apart that our present knowledge of underground drainage conditions does not permit of definite conclusions being drawn as to maximum concentrations which may be encountered in any locality.

5. Since it has been conclusively demonstrated that concrete of the best quality may be disintegrated the first step of the investigation may be considered complete. The second step, the finding of some means of preventing disintegration of concrete by alkali salts, other than by drainage is dependent upon chemical research Bituminous waterproof coatings and that class of materials. have merit but can be used only under certain conditions. What is desired is a cementing material having all the good properties and advantages of our present Portland cement with the additional quality of immunity to the action of alkali salts.

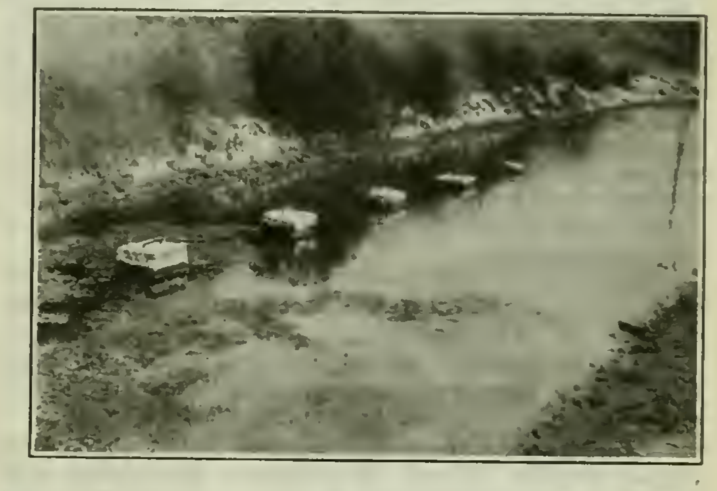


Fig. 8.—View of portion of the blocks installed at Mesquite N. Mex. after four years exposure. All blocks at the project show signs of disintegration. Concentrations of salt in water have been as high as 3%.

Notes on the Audion and its Application

The development of the thermionic valve and its application to telephony

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Paper presented at the Tenth General Professional Meeting, Saskatoon, August 10th.

The development of telephone engineering within less than fifty years since the original invention of the first crude and cumbersome telephone by Bell has been so rapid that it has been practically impossible for the engineering profession as a whole to keep in touch, except in a very superficial way, with the various developments which have been made.

As far as exchange systems have been concerned the evolution has been roughly from Magneto to Common Battery to Automatic, and the present equipment and circuits are so fundamentally different from those originally used that it can readily be seen that the economic and engineering problems involved in converting from one system to another without interrupting the service during this gradual process of evolution have been very great, particularly to the pioneers who have adopted them thus enabling tests under commercial conditions to be made without unnecessary delays. This progressive policy has probably been one of the main reasons for the very rapid strides made in the development of this industry within the last decade.

The very rapid development and extended use of exchange equipment has naturally lead to an increasing demand for toll facilities.

The development on toll line engineering has been from iron to copper circuits with increases in the gauge of copper until economic limits were reached.

Efforts were then concentrated on increasing the circuit facilities without corresponding capital lost, and phantom circuits were brought into use extensively and construction methods modified to suit these conditions. At the same time steps were developed to reduce the distortion on the lines and loading coils were perfected and used. As these, however, increased the attenuation on the lines the maximum results could not be attained without some form of commercial repeater.

The development of such a repeater has been the dream of every telephone engineer, and when it is realized that in the telephonic speech wave the energy available is of a magnitude of 10^6 watts and has an alternating frequency of roughly 200 to 2000 periods per second averaging 800 periods per second, the fact that any results were attained with mechanical repeaters is marvellous.

Variousv ery ingenious devices were tried from time to time for amplifying the attenuated voice currents at intermediate points on the line and at the receiving station, but due to the very complex nature of the voice waves and lack of equipment and research facilities which involved expert knowledge of physics, mathematics, etc., it may be said that no entirely satisfactory repeater was developed which would give two way service required for commercial telephonic transmission until the thermionic valve was developed and used in the electronic detector and amplifier. It was only then that transcontinental transmission either by wire or wireless became an established fact. As a matter of interest it may be stated that the loading on the first transcontinental line has now been entirely cut out and repeater stations substituted, it having been found that by spacing these comparatively close together the distortion of the speech wave, due to capacity, could be neglected as far as the commercial transmission was concerned. The evolution and development of the thermionic valve is probably one of the most far reaching and remarkable inventions in the field of modern applied science.

The Thermionic Valve

Thermionic emmission was first observed by Edison between 35 and 40 years ago, but it was not until the last 20 years that a satisfactory theory was advanced for the thermionic emmission of electrons. This theory which has now been generally accepted, roughly is that every metal contains within its area a very great number of free electrons which being so minute are able to move freely through the metal. As, however, the metal and particularly the surface, has an appreciable attraction on the contained electrons, it is necessary to increase the kinetic energy of same, so that they can dissociate themselves from their containing molecular matter. When the metal is heated the kinetic energy of the electron is increased as also the number of electrons emitted from the surface. As the temperature is raised to incandescence the flow of electrons increases proportionately. To obtain the maximum results the emitted electrons should be unimpeded by molecular matter, therefore if the discharge of electrons takes place in a very high vacuum their movements will approximate as closely as possible to the movement of free electrons. It was later discovered by coating the metal conductor with certain oxides that the phenomena of thermionic emmission was enormeously increased compared with the original metal.

One of the first practical applications to which the above theory was adapted was the thermionic value developed and perfected in 1914 by J. A. Fleming of London University and universally known since as the Fleming Valve.

Fig. 1 shows a valve of this type and consists of a glass bulb exhausted to a very high state of vacuum enclosing a carbon or metal filament "F" and a metal plate or Disc "P".

The Fleming Valve

By passing a known current through the filament (Fig.1, Battery "A") it can be heated to incandescence, when it becomes radio-active emitting streams of

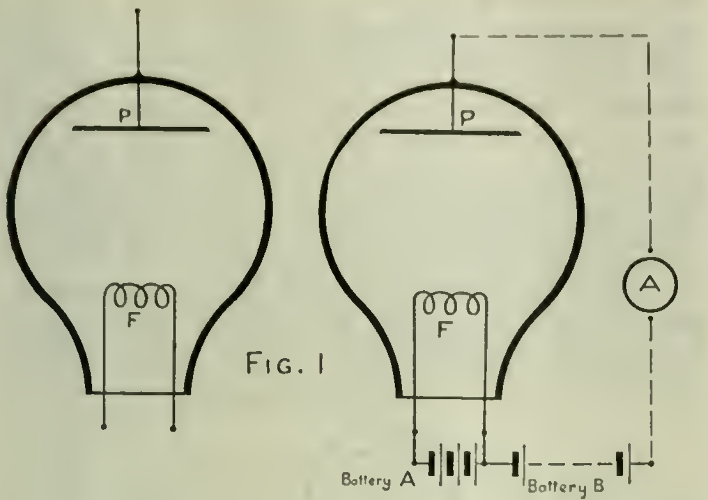

Fig. 1

electrons from its surface. These electrons are negative in polarity and are thrown off at an enormous speed under certain conditions attaining a velocity approximating 186,000 miles per second. If a potential difference be now created between the filament and plate (Fig. 1, Battery "B") so that the plate becomes positive to the filament, the stream of negative electrons emitted by the flow will be attracted to the positive plate creating a flow in the vacuous space between filament and plate as the stream of electrons constitute an electric current the vacuous space may be said to have become a conductor It will be noted that this flow of electrons does not follow the accepted direction of flow in an electrical circuit, being in the reverse direction, the current is also not constantly equal to the ratio E/R but follows a curve similar to Fig. 2. for various types of valves.

On the abscissa is plotted plate voltage in volts and on the ordinates plate current in milli-amperes. From this it will be seen that with a given current on the filament the plate current increases very gradually as the plate voltage is raised from zero to "A", the increase being very rapid as the plated voltage is increased from "A" to "B" and is negligible from this point on.

The Fleming or two plate valve has no amplifying properties, being merely a rectifier. The general adoption of the term valve for the thermionic detector is no doubt due to the fact that it is only conductive in one direction, that is from the filament to the plate. This can be shown by reversing the potential difference between filament and plate, when the flow of electrons will cease as well as any current flow in the external circuit. This can be seen if a suitable measuring instrument is placed in the external circuit. (A, Fig. 1.) Two element valves were quickly adopted by radio engineers as rectifiers and detectors of wireless waves but it was not until the discovery by De Forest in 1906 that by introducing an additional electrode between the incandescent filament and plate the electron flow between the filament and plate could be controlled and regulated that the most sensitive repeating device at present known was developed.

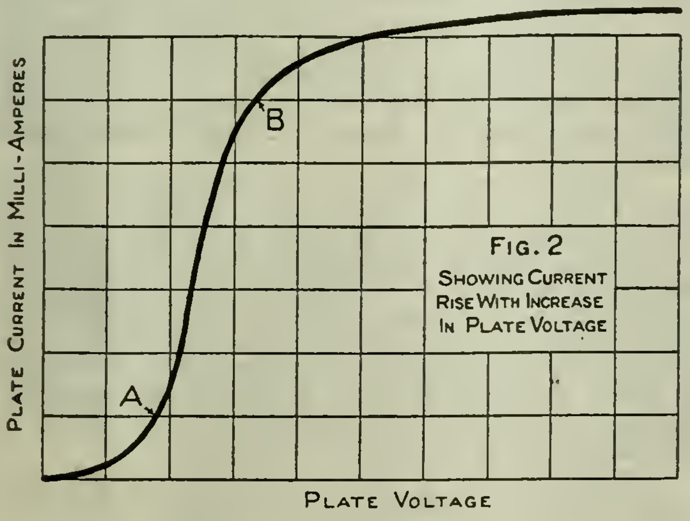

Fig. 2
Showing Current Rise With Increase In Plate Voltage

Development from the Fleming Valve

By inserting a metal electrode or Grid "G" Fig. 3. between the plate and filament and applying a difference of potential battery "C", Fig. 3. between the grid and filament keeping the plate potential and filament current constant, the previous balance existing between the plate and filament becomes altered, the current in the plate circuit through battery "B" and instrument "G" alters correspondingly.

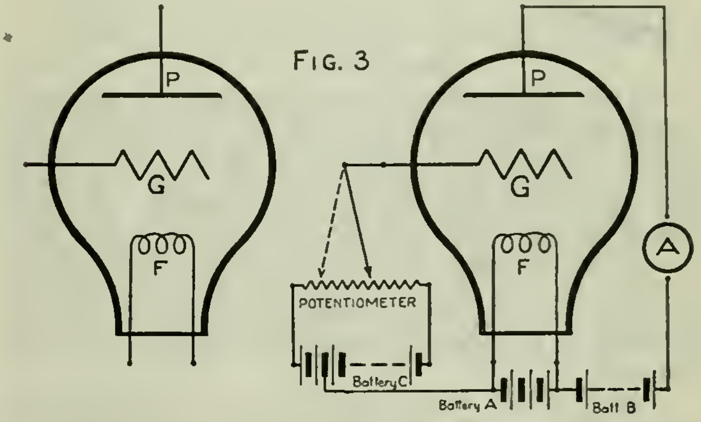

Fig. 3

By arranging battery "C" so that the grid is positive to the filament additional electrons will be carried across the vacuous space. As the grid allows most of these electrons to pass through to the plate the current in that circuit will be considerably increased. As, however a certain number of the electrons strike the grid there will also be a small flow of current in the grid circuit tending to cause a flow from the grid to filament. By adjusting the potentiometer so that the grid becomes negative in polarity to the filament, a decrease in the plate current will take place, due to the repelling action of the negative grid which will interrupt the flow of electrons from the filament to plate, and there will now be no flow of current in the grid circuit as the negative electrons will not pass to the plate or grid unless it is positive in polarity. Keeping the current on the filament and voltage on plate constant and adjusting the grid voltage from a negative to positive value we arrive at the characteristic curve, Fig. 4A showing the relation between the grid voltage and plate current Fig. 4 shows the negative half of this curve enlarged.

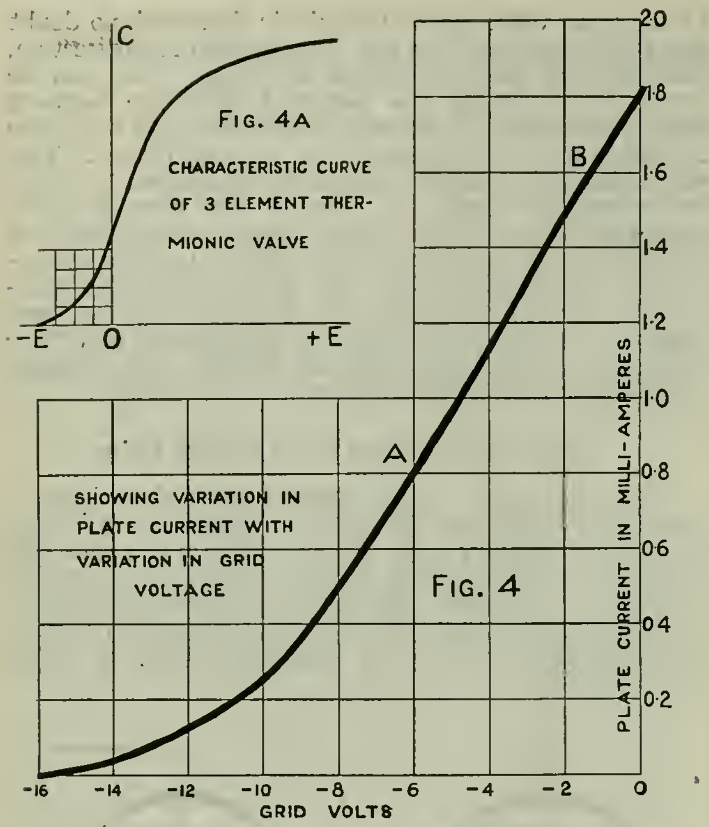

FIG. 4A

CHARACTERISTIC CURVE OF 3 ELEMENT THERMIONIC VALVE

SHOWING VARIATION IN PLATE CURRENT WITH VARIATION IN GRID VOLTAGE

FIG. 4

If the plate voltage is now increased or decreased the character of the curve does not alter, the plate current however increases or decreases in proportion bringing out the fact that the negative potential which it is necessary to apply to the grid in order to reduce the plate current to zero value, is in direct proportion to the plate voltage but of much smaller magnitude. From this it will be seen that there are two methods of altering the plate current, namely, by minute variations of the grid, potential or by relatively large alterations in the plate voltage.

As explained before, as long as the grid potential is kept of a negative magnitude there is no flow of current in the grid circuit. This was rendered possible by Lowenstein in 1912 who suggested the use of a negative battery in the grid circuit. Therefore if the circuit can be so arranged that we can utilize that portion of the curve between say "A" and "B", Fig.4., any variations of the incoming voltage will be entirely wattless as no current flows (Watt=CE). From the above it can be readily seen the possibilities of the 3 element thermionic valve as an amplifier are practically unlimited, as the slight variations of the incoming voice waves without loss of energy will create an exact amplified reproduction without distortion in the plate circuit, but with an energy output of from 12 to 16 times the magnitude of the incoming impulses.

The voltages involved in radio work are of smaller magnitude than those encountered in telephone transmission, and until recently their work and requirements only involved one way transmission, valves with slight variations of characteristics and containing a certain volume of gaseous matter did not interfere seriously with the development of radio work. It was fundamentally different with telephone transmission and before the 3 element thermionic valve could be applied as an amplifier and repeater very considerable research work had to be done to design a suitable valve with a practically perfect state of vacuum. At the same time research work was carried out so that valves could be manufactured with exactly the same characteristics. The scope of this article however, does not cover this portion of the work. As a matter of interest however, it may be mentioned that those intrusted with this work have been entirely successful thus enabling very rapid strides to be made by the telephone engineers along these lines.

Figure 5 illustrates one of the simplest forms of a telephone repeater circuit and an endeavour will be made to show the amplification due to the various types of thermionic valves available with this circuit.

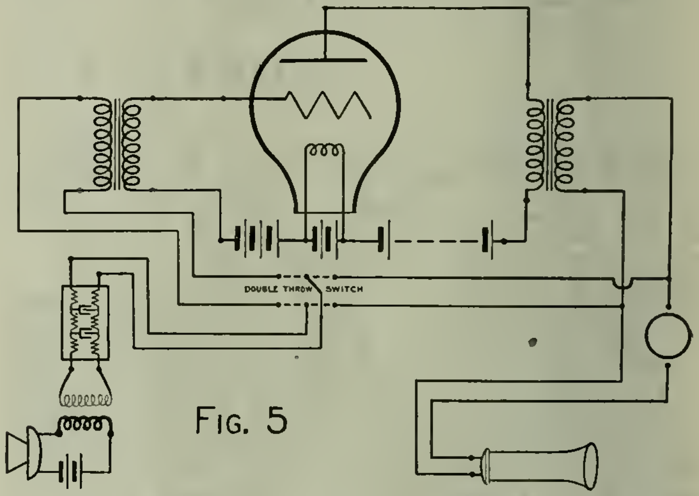

FIG. 5

A slight endeavour has been made in the preceeding paragraphs to show the scope of the thermionic valve, which has practically revolutionized radio and telephonic engineering, but there is another application of the valve which will possibly have even more revolutionary effects on the trend of modern applied science. This is the adaptation of the 3 element valve as an oscillator or generator of high frequency alternating currents which with the devices at present available seem to have a possible range up to 100,000,000 cycles per second. Its present use except for experimental and research work is limited however on account of the relatively small amount of power available which is in the neighborhood of 500 watts, but this, on account of the controlling effect that can be obtained by the grid potential can be varied within the frequencies given above. From this it will be seen that we have in the 3 element valve the most easily maintained and operated and most flexible generating device known.

The factors controlling the power output of the valves as at present designed are the filament current and also the dissipating power of the plate which heats up, due to radiation from the filament and also the intense bonbardment to which it is subjected by the negatively charged electrons. These, as before stated, are normally thrown off at an enormous speed, this speed being considerably accelerated as the positive potential of the plate is raised so that what might be termed the saturation point of the incadescent filament as far as its power to discharge streams of electrons is limited.

Research work is, however, proceeding, and it is suggested that substitution of the elements concerned, as say a radio-active substance such as radium for the filament, the discovery and substitution of a plate element having a greater dissipating capacity per area and modifications in the design of the vacuum containing chamber would increase the range of frequency and the power output available, opening up many new fields for the engineer to conquer.

As pointed out before, the radio engineer adopted and utilized the valve most extensively when it was originally brought out. The telephone engineer on account of the more rigid requirements of design and manufacture necessary to adapt it for his use not being able to utilize it to full advantage without further very necessary research work. On account of having to do this research work it might be said that development and perfecting of the valve has been largely the work of the transmission engineer.

The Thermionic Valve in Multiplex Telephony

The idea of multiplex telephony and telegraphy are by no mean new, and various inventions were made along these lines from time to time but it was not until 1910-11 when Major Squier who is now Senior Signal Officer of the U.S.A. army, propounded his theory of carrier currents for multiplex work that any very marked progress was made along these lines.

The general principle of carrier currents or channels is that any number of audio or radio frequencies, provided they are of a higher order than those used in telegraphy and telephony and are not within the same range of harmonics, can be simultaneously carried over a pair of wires without interference. By super-imposing voice waves and telegraph signals on these channels multiplex telephony and telegraphy can be carried out over a single pair of wires and at the same time the wires can be used as at present for a telephone conversation.

It is not proposed to go into the various steps adopted in the perfecting of the equipment and circuits beyond pointing out that the original equipment used to obtain the high frequency oscillations for the carrier channel, the modulator or device used to impress the voice currents on the carrier channel thus obtained and the demodulator used at the receiving end to detect and restore to their original form, the incoming signals have all been discarded in favour of the 3 element thermionic valve. On account of the relatively high attenuation of these carrier channels this valve has also been adapted as an amplifier on the carrier channels.

One of the most important developments lately has been the invention of what is known as the "Band Filter" by Campbell which has allowed frequencies within closer limits and within audio ranges to be more extensively utilized for carrier channels, thus reducing the transmission losses to a minimum.

As a matter of interest it may be stated that practically simultaneous developments of carrier currents or channels were developed in America and Germany but due to conditions following the war very little information is available on the German systems..

Accepting the principle of artificially created carrier waves or channels and the ability to invent devices such as the modulator and demodulator valve to harness these channels for the conducting of complex voice currents or simple telegraph waves, or in other words, energy and power, is not the next logical progressive step to survey the resources of nature to see if we have not provided and at hand a practically unlimited number of carrier channels of indefinite power and range not subject to interference or distortion? There is an almost limitless field thus opened to the scientist and engineer. For instance with a simple device like the prism, the 49th octave of light can be split into seven channels.

From results obtained it would appear as if the human brain is a modulator and demodulator in as far as the conveyance of "mental" pictures and messages is concerned, but with our occidental minds are we not all too apt to class as quackery any phenomina for which we cannot advance a reasonable explanation and theory. The X Ray tube seems to have harnessed the highest frequencies at present utilized but the possibilities of the ranges beyond this point are untouched.

We are told that genius is akin to madness but history has shown that things which appear impossible or to be more correct beyond our limited comprehension in our generation are the established facts on which the progress of the succeeding generations are based. To what lengths could not the engineer go if he would, instead of converting the dreaming of a Jules Verne and H. G. Wells or a Bulwar Lytton into facts, take a peep over the walls of the narrow ruts and furrows created by our predecessors and allow his imagination to soar over the wider fields of the yet unexplored and vast resources of nature.

As a profession we are creating too wide a barrier between the research engineer or scientist (physicist and mathematician) the commercial or executive engineer and the operating engineer, laying too much stress on the latter class with the result that looking over the names of those who have done most for the advancement of scientific knowledge during the last fifty years we find scientists, as differentiated from engineers, laymen and mechanic predominating. The engineer with his nose to the grindstone instead of being the creator is degenerating into the copyist, improver and adaptor of another's designs and ideas.

The crest of a Scottish town whose growth has been very closely associated with engineering development, has among other things a wharf with two men supervising a third man rolling a keg. The motto is "God Speed – – – – – – – – – – – – ".

We are getting as a body, perilously near to the condition of the supervisor, and unless we close the breach between the three closely allied branches of the profession mentioned before, and allow our imagination a little more play and develop our commercial capabilities and thus become creators in the widest sense of the word, it is only a matter of time before the professional engineer as at present designated will become man Friday to the scientist and executive and the motto of the town above mentioned would make a very suitable epitaph.

If on the other hand however, we break away from our narrow ruts, and during this world period of re-construction specialize if necessary, but not to the detriment of our development as engineers, and combine our scientific and engineering resources the next decade should be one of the most pregressive in the history of engineering, and the day will not be so far distant when the limitless resources of nature will have been harnessed for the benefit and use of mankind.. This will only be possible however, if we allow our imagination to rise above the present narrow confinement and soar into the possibilities of the infinite, using our knowledge and resources as engineers to make our dreams come true.

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

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Annual Meeting Announcement

The annual general meeting of *The Engineering Institute of Canada* will be held at Montreal on Tuesday, January 24th, 1922, at ten o'clock A.M.

At this meeting the formal business of the annual general meeting will be presented. The agenda will consist for the most part of appointments of scrutineers; appointment of auditors; reception of reports, (a) report of Council, (b) reports of committees, (c) reports of Branches; new business; reports of scrutineers announcing election of officers.

This meeting will be adjourned to Winnipeg, February 21st, 22nd and 23rd, where unfinished business of the annual meeting will be continued and the annual general professional meeting will be held under the auspices of the Winnipeg Branch. The programme of the professional meeting, details of which will be announced later, is at present under consideration by the Winnipeg Branch.

The Winnipeg Branch anticipates, and is providing for a large attendance and it is sincerely hoped that many members both East and West of Manitoba will plan to be present. It is expected that special arrangements will be made for a train from the East, and possibly from the West coast, for those attending the meeting.

Military Records

Although a careful compilation has been made at the headquarters office of the splendid war records of our many members who served with His Majesty's Forces, it is realized that the data at present available is not sufficiently complete to enable *The Institute* to issue the final roll of honour as a permanent record. As the office has no mailing address for the men of this group it is desirable that a careful scrutiny be made of the "addresses wanted" appearing on page two hundred and forty of the current year book and headquarters advised of the present address of the men who are indicated as having served at the Front.

If each member on reading this will kindly spend five or ten minutes going over this list and send to the to the office the desired information it will no doubt result in bringing our roll of honour to a much more nearly complete condition than obtains at the present moment. Any effort made by our individual members in this connection will be greatly appreciated.

The Leonard Foundation

Past-President Colonel R. W. Leonard, M.E.I.C., has established a foundation known as "The Leonard Foundation", of which the Toronto General Trusts Corporation are trustees.

In view of the fact that there are many members of *The Institute* who have seen service in the British wars, whose sons would be eligible for scholarships under the Leonard Foundation and because of the position Colonel Leonard occupies in the engineering profession in Canada, a brief outline of the Foundation is opportune.

These scholarships are designed to assist in the education of the sons of clergymen and school teachers (British subjects) and of officers, non-commissioned officers and men of the permanent British and Canadian army and navy and of veterans who have taken part in any of the British Empire's wars, who, without assistance would be unable to give their sons the desired education. The Foundation will, at present, permit of the granting of about thirty scholarships annually. Provision has also been made to a limited extent, for female students of like parentage, who may be awarded scholarships in any of the four Ladies Colleges shown in the list· It is proposed to add to this list the name of a university at which scholarships in civil engineering may be granted.

The names of the Colleges and Schools are as follows:—

(1) Ridley College, St. Catharines, Ont.
(2) Lake Lodge School for Boys, Grimsby, Ont.
(3) The Lakefield Preparatory School at Lakefield Ontario, of which Alexander Mackenzie is at the date hereof Head Master.
(4) Havergal Ladies College, Toronto, Ont.
(5) The Rothesay Collegiate School, at Rothesay, N.B.
(6) The King's College School, at Windsor, N.S.
(7) Edgehill Church School for Girls, at Windsor, N.S.
(8) King's Hall for Girls, Compton, Province of Quebec.
(9) Wycliffe College, Toronto, Ont.
(10) The Church of England Deaconess and Missionary Training House, at Toronto, Ont., which House is herein classified as a College.
(11) The Royal Military College, Kingston, Ont.
(12) The Royal Naval College, Esquimalt, B.C.
(13) The Anglican Theological College of British Columbia, of Vancouver, B.C.
(14) The Ontario Agricultural College,at Guelph, Ont.
(15) The MacDonald College, Ste Anne de Bellevue, Province of Quebec.

And such additional Universities, Colleges and Schools, if any, as the Founder may from time to time during his lifetime designate, or such as may be constituted for any now selected or hereafter to be selected, the intention being that the number of such Universities, Colleges and Schools shall not be reduced below the present number of sixteen.

Other information can be obtained upon application to W. G. Watson, ass't general manager, Toronto General Trusts Corporation, to whom all communications should be sent in connection with these Scholarships.

Engineering Societies Dues

A comparison of the dues paid by the various grades of members in *The Institute* with those of other Engineering Societies is published at the request of one of our Branches. The figures indicate dollars in every case.

The Engineering Institute of Canada:

	Mem.	Ass. Mem.	Assoc.	Jr.	Stud.
Entrance.....	25	15	15	10	
Transfer.....	Difference in entrance Fees.				
Annual					
Res........	15	12	19	8	3
Br.........	12	10	15	6	3
Non. Res...	10	8	15	5	3
Life	150				

Institution of Civil Engineers: (Great Britian)

Entrance.....	100	50			
Transfer.....	50				
Annual......	20	15	15		10
Annual (non-res.)..	15	12.50	12.50		7.50

American Society of Civil Engineers:

Entrance.....	30	25	20	10
Annual				
Res..........	25	25	15	15
Non-Res.....	20	20	15	10
Life........	250	150		

American Society of Mechanical Engineers:

Entrance.....	25	25	25	15
Annual......	15	15	15	15
Life.........	Annuity sufficient to pay dues.			

American Institute of Electrical Engineers:

	Fellow	Member	Ass. Mem.	Assoc.	Stud.
Entrance.....	20	15		5	
Transfer.....	5	10			
Annual......	20	15		10	3
Life.........	400	300		200	

American Institute of Mining And Metallurgy:

Entrance.....		10		10
Annual......		15		12
Life.........		150		150

Note:—British fees at £1.1.0 — $5.00.

EMPLOYMENT BUREAU

To make this department more valuable it is proposed that in future advertisements of situations vacant should state salary, and give details of requirements.

Situations Vacant

Mine Surveyor

Mine Surveyor for colliery in Alberta. Box 202.

Professor

Position vacant, Professor of Electrical Engineering in College in Eastern Canada, duties to commence October 1st, 1921, for particulars write Box 203.

Engineer for Chemical Plant

Plant superintendent for chemical by-product recovery plant in West Virginia to take full responsibility, chemical engineer or mechanical-electrical engineer with chemical experience. Salary about $6000.00 per annum. Box 206.

Situations Wanted

Civil and Mechanical Engineer

A.M.E.I.C., registered professional engineer (civil and mechanical) desires change. Would consider engagement with manufacturing firm as sales engineer or representative. Box 77-P.

Civil Engineer

Graduate civil engineer (Toronto University 1921) desires to locate with consulting or contracting engineering firm. Four years experience on structural steel work of all kinds. Good draftsman S.E.I.C., age 25. State salary offered and prospects for advancement. Box 78-P.

Civil Engineer

Graduate civil engineering, A.M.E.I.C., age 27. Six years engineering field work and drafting office. Experience includes railways, construction, municipal and mining. Open for engagement on short notice. Details and references on request. Box 79-P.

Technical Graduate

A technical graduate is immediately available for engagement with contractor or engineer. Experience covers industrial plants, pulp and paper mills, hydro-electric power plants, railway location and construction dams, irrigation roads. Suited for employment as field engineer, superintendent, foreman or inspector. Box 80-P.

Mechanical Engineer

Graduate mechanical engineer B.Sc., A.M.E.I.C., A.M.I.M.E., Canadian, aged 32, married, with eleven years experience in various branches of mechanical engineering, desires position as engineer with reliable manufacturer or firm of consulting engineers in Canada. At present employed. Thorough training and testing of locomotives, marine engines and turbines, centrifugal pumps, blowers and compressors. Full particulars of experience and best references furnished. Box No.-81-P.

Members' Exchange

Building for manufacturing plant wanted in Montreal or Toronto district. Dimensions 150 to 200 feet by 60 feet, preferably two or more stories. Business is manufacture of high speed tolls, steel castings etc. A plant with foundry and machine shop or facilities for building would be acceptable. Box 15-A.

The Library of Congress, Washington, D.C., desires a complete set of the Journal to commence with the first issue. To complete the set we require a copy each of the following:—

1918 – May to December.
1919 – January to April, and October.
1920 – August.
1921 – January, March and April.

Any member desiring to supply a copy of any or all of the above will be conferring a favour upon "*The Institute*" by forwarding such copies to the Secretary.

CORRESPONDENCE

Brazilian Notes

Editor, *Journal*:—

Dear Sir:

I have to thank you very much for yours of the 9th inst. welcoming me back to Canada. It was a very pleasant ending to a very delightful trip to find that I had not been forgotten by my kind friends at home.

In response to your request I may begin by saying that my first realization of the importance of South America came home to me when I boarded a luxuriously fitted steamer of 10,500 tons in New York, the Vestris of the Lamport and Holt line and found that she was sailing direct for Rio de Janeiro and Buenos Aires without any intermediate stop. I had travelled on the fine steamers of the Mexican line and those of the Southern Pacific and had been several times along the Spanish Main and knew the Italian and French liners plying between Colon and Mediterranean Ports but here was a British ship making a straight run of 5000 miles without a stop purely in the interest of Brazilian, Argentinian and Uruguayan trade and merely one of a number of great steamers fostering this trade. The United States has another fleet of the Munson line also sailing from New York and the Brazilian Lloyds still another line, and from Southampton is the still finer service of the Royal Mail Steam Packet Company.

It is hard to imagine a much pleasanter sea trip than that from New York to Rio in winter. In 36 hours we were across the Gulf Stream and into sunny latitudes and on the 3rd day we picked up the N.E. trades which blew steadily down to the equator, then a day or two of "Doldrums" and then the S.E. Trades on the port bow for the remainder of the voyage. The first sight of South America was the lights of Permanbuco on the 11th day out. The sea had been a lonely one so far for most steamers from New York touch at Barbadoes if not more of the West Indian Ports and we were far outside their track but from Cape San Roque South we were in the direct line not only from New York, but from England and the Mediterranean and had vessels of all kinds about us at all hours of the day. On the 14th night we rounded Cape Frio and at daylight next morning crept quietly in under the Sugarloaf and just before sunrise anchored in Rio's great harbour. At sea we had almost invariably had rather commonplace sunrises and sunsets, the sun jumping up suddenly into an almost cloudless sky but in Rio this was the rainy season and there were streaks of clouds and mist over the mountains and some gorgeous colouring effects as the sun burned them up but when he got through with his work he came out very strong indeed and gave us a magnificient view of the city and the bay and the wonderful mountain scenery around it. Rio is built upon low flat ground at the base of a chain of high hills and through this flat stick up a number of conical hills of granite and gneiss. One or two of these have been levelled down to make room for the city's growth, two others are surmounted by old fortifications and by an observatory and a third has an evil reputation as the home of the most criminal element and as not being safe for pedestrians at night. The most famous and picturesque of all is the Sugarloaf guarding the entrance to the harbour, and bathing its feet in it.

Behind this flat ground rises the main mountain range and here climbs the residential suburb Santa Teresa. Higher still is a densely forested mountain slope and dominating all are the peaks of the Corcovado and Tijuca 2200 to 2500 feet high.

Turning to the North a great mass of mountains loom up some 40 miles away with the two "fingers of god" sticking up from the flanks and to the East is the City of Nictheroy across the harbour and more jagged pinnacled mountains rise behind it.

Rio is beautiful viewed from the outside and it is scarcely less beautiful when you get into it. A generation ago it was a hotbed of yellow fever and malaria. It is now one of the healthiest and cleanest cities in the tropical world and is full of handsome buildings and beautiful parks and driveways, while enough of the old city remains to interest one and remind one that it has a history dating back to the beginning of the 16th century and is one of the oldest cities of the new world. It is also one of the largest with a population of nearly one million two hundred and fifty thousand, and it is the capital of a country larger than the United States, with over 25 millions of inhabitants and possessing all kinds of climate from temperate to tropical and producing almost everything that can be grown in such climates on a fertile soil.

These facts and a great many more can all be found in the Gazetteers and encyclopœdias, but they do not seem to have been brought home as yet to the ordinary North American, and this is my excuse for dragging them up and parading them.

My mission to Brazil had to do with railways and while I heartily appreciated the beauties and pleasures of Rio I had to keep the main object in view and I early introduced myself to the director of government railways, Senor Robeiro whom I found to be a most courteous and unassuming gentleman who had been in Canada and spoke English very well although not fluently. His courtesy took a very practical form and over the inevitable cup of coffee he tendered me the freedom of his line and a trip over the most interesting portion of it personally conducted by his traffic manager and one of the engineers; with profuse apologies for not been able to come himself. The portion in question was the mountain section of the "Serra de Mar", the trip took the best part of a day and was of absorbing interest throughout.

The "Central" is the main artery entering Rio from the West and South of the States of Minas, Geraes and Sao Paulo, a broad gauge of line of 5'3" and has a very heavy traffic for the first 70 miles to Barra Mansa and is double tracked over this portion. The grade of 2% has had to be developed considerably on the mountain side hills and there is a very considerable length of tunnelling. The double tracking of these tunnels without interfering with traffic is a work of which the engineers are very proud and justly so, for the material is almost always bad and much soaked with water, in one case a considerable stream is carried overhead with very small clearance. The immediate entry to the city is also very interesting as the suburban traffic is enormous. The director claimed that 100,000 passengers were handled daily which I believe is greater than on any single road entering New York. You will have noticed that the Republic has recently borrowed $25,000,000 the greater portion of which is to be spent on the electrification of this particular road. The electrification "bug" has taken a very strong hold on Brazil and with good reason for coal is very high priced, wood nearly exhausted in this part of the country and water powers are quite numerous and partly developed with good results. The absence of snow, frost and ice simplifies a good many of the railway problems for Brazil, this among others.

Another important railway system entering Rio is the Leopoldina from the North and East. Time did not permit my travelling over any of this except the very interesting line to Petropolis, a summer resort among the mountains reached by a section of rack railway with a grade of 8% or 10%. From Rio to Sao Paulo is a run of some 300 miles, not especially interesting after the mountain section abovementioned is passed. It follows the valley of the Parahyba river for 150 miles or more with a very large amount of curvature but generally easy grades.

Sao Paulo is another attractive city a little larger than Toronto and the capital of the state of the same name, the banner state of the republic. Sao Paulo is immediately upon the tropic of Capricorn but it is 2700 feet above sea level and the climate is decidedly temperate and very different from that of Rio which is tropical. The State of Sao Paulo produces about one half of the world's supply of coffee and one hears of very little else. 3,600,000 people are more or less directly interested in coffee and they drink coffee, talk coffee and I believe dream coffee almost ad nauseam. Like everyone who puts all his eggs in one basket Sao Paulo has had some serious times when the market for coffee has gone bad or the season's crop has not been up to standard and as in our own North Western plains thet endency, is to go into other products. Sao Paulo can grow almost anything in the way of tropical and subtropical crops and is growing maize, cotton, rice, bananas, grapes, tobacco and many other products, and the more remote portions where land is cheap are raising cattle and hogs. There have been and are still magnificient forests in Sao Paulo and as in our own Ontario and Quebec, these have been partly cleaned and burned to make way for coffee. Coffee could be marketed readily, the timber could not, but again as with us the time has come or is fast coming when the timber is the more valuable of the two. Sao Paulo has the advantage over Canada that her forest growth is much more rapid and her case is not so discouraging as ours, also the Brazilian has had the benefit of North American experience and shows a disposition to profit by it. The Brazilian too is a home lover and not quite so anxious as our prairie farmers to get the last bushel of wheat off his land, sell out, and make for Southern California with the proceeds.

The State of Sao Paulo was explored and settled from the little town of Sao Vicente which was founded very early in the 16th century on a sandbank between the sea and a mangrove swamp. A large tidal river flowed through the swamp and floated large boats and canoes to the very base of the Serra do Mar. Thence a portage of some eight miles was made up a mountain gorge and over a divide of 800 metres to a stream flowing Westward to the Tiete. The Tiete in turn flowed on to the Paranâ and the Paranâ to the Paraguay and together these two formed the Rio de la Plata. At the junction of this stream with the Tiete where the navigation became wide and open was founded the town of Sao Paulo. The harbour of Sao Vicente was not suited for large vessels and was replaced by that of Santos a couple of miles further East, and in 1869 over three hundred years later an English company undertook the construction of a railway over the mountains to replace the mule trail, 2700 feet or so in 6 or 8 miles was too steep for adhesion and the days of grade development had not arrived at any rate in England or Brazil so the expedient of rope traction on a 10% grade was adopted and the now famous Sao Paulo railway was evolved and is to this day doing business. Sao Paulo, city and state grew and prospered and now the business has become so great that the line is congested and a clamour is being raised for a newer and more up to date railway to the sea to provide for the ever increasing trade. I have said that the state had a population of 3,600,000 which seems a good deal for 100,000 square miles of territory, but as a matter of fact only one half (the Eastern) is settled and the Western half has only started. Another 25 years will probably see the population doubled and beyond Sao Paulo are the states of Mattogrosso, Minas Geraes rich in cattle and minerals and beyond these again is a region of unknown wealth stretching to Bolivia and the Amazonian forests. It is the development and service of this enormous territory which is now attracting the attention of Brazil and the outside world and more particularly the government of the state of Sao Paulo and it is a solution of this problem which I went to Brazil to enquire into. The problem is complicated by the fact that the interior development of the state and republic has been effected by metre gauge railways and something like 80% of the mileage of Brazil is built to this gauge which has become standard. The Sao Paulo was built to 5′ 3″ and has enforced this gauge on the connecting lines of the "Central" and to a certain extent on that of the Paulista because these use the same terminals in Sao Paulo but a great mileage of other roads, some 4000 in Sao Paulo alone showed no disposition to make any change which is naturally a matter of enormous expense to them and the result is an inconceivable amount of transhipment which added to the already high rates makes the cost of transportation very high. Coffee being a high priced commodity does not feel this very much, one 1/5 of a cent per pound does not mean very much, but a demand is growing for timber, cordwood, ties, maize and a number of other of the cheaper commodities and in their case the transhipment *is* a heavy burden. Years ago the battle of the gauges was fought out and the Western world decided in favour of the moderate 4′ 8½″ but South America never accepted this decision and thousands of miles are built of from 3 feet to 3′ 6″ with probably about one half or more of the metre standard. I have come to believe that there is more in the narrow gauge construction than we believe and that the difference in cost of construction and maintenance is very considerable but in any case 5′ 3″ gauge is almost unthinkable as a standard for the whole of Brazil and is neither fish, flesh nor fowl. If it cannot become standard why perpetuate it? To widen the existing narrow gauge system even to 4′ 8½″ is a much more serious matter than is involved in the mere spreading of the rails and widening the cuts and fills and purchase of new rolling stock such as was done on our own Toronto and Nipissing and Toronto Grey & Bruce South American roads are replete with tunnels and viaducts, retaining walls etc. etc. Every yard and every clearance would have to be altered and in many cases the location changed as is actually being done on the Paulista at this moment. It is physically possible to run standard gauge trains on curves of 20 degree and even much sharper. As a question of economics it seems to be very doubtful indeed, but with the metre gauge they are not only operating such curves successfully but in a great majority of cases earning good money and paying dividends, whereas with the exception of the Paulista which has not completed its experiment as yet the broad gauge system with a very considerable traffic is not paying its way.

From Sao Paulo I went Northwards to the confines of the State and saw what wonders these narrow gauge lines had accomplished in conjunction with a fertile soil and a liberal immigation policy. Every few miles was a populous well built town with water and electric light and all the modern "frills". Few of these towns were more than 10 years old, many only 3 or 4 and the railways which had built them had seldom cost more than $18,000 per mile through a country by no means flat and I could not but wonder what would have eventuated in our own Northwest if our tastes and desires had not outgrown our purses and had we been content with the cheap lines which had developed Minnesota, Dakota and Manitoba. My objective in the North was the Moribondo falls on the Rio Grande but the rainy season was on, rivers had overflowed their banks and carried away bridges and roads were for the time impassable so I went Southward again and then West and over a long stretch of metre gauge line into the state of Parana and over the Sao Paulo, Rio Grande to Punta Grossa and its capital Curityba a pleasantly situated cleanly modern city of 80,000. The Sao Paulo, Rio Grande is a wonderful piece of line winding in and out of every stream valley and on one stretch making 90 kilometres of running to gain

45 in a straight line and the profile was just as remarkable as the alignment, but here again was a line handling a large traffic and doing it profitably and in a lesser degree, for Paraná is not as old and wealthy as Sao Paulo, doing the same building up of neat towns and villages, but Paraná is a timber state full of great pine forests and frame houses with shingle roofs took the place of the brick and stucco and tiles of Sao Paulo to a large extent and instead of boundless coffee plantations there were pine forests alternating with open "campos" of grassy uplands. From Curityba I took another railway, the Paraná to the sea coast at Paranagua. It is one of the scenic railways of the world breaking suddenly through a half mile tunnel from the plateau to the wild mountain scenery of the Serra de Mar and descending 2700 feet on a maximum grade of 3% to the coastal flats. For miles we hung on a slope sometimes so steep that even a retaining wall could not be trusted and the line had to be carried on steel; when it became still steeper we dodged into a tunnel, 1,500 feet above the peaks of the Serra were wreathed in mist and 1000 feet below a mountain torrent roared and plunged and chafed. It was a wonderful trip worth the long journey from Sao Paulo in itself and I take off my hat to the plucky Brazilian engineer who claimed that the thing could be done and did it. Another side trip took me into the reported coal measures of Paranâ. The coal was of doubtful value commercially but the drive through the forest and across the campos behind a four horse team and a half drunk driver and the glimpses we got of home life in the outlying settlements of Brazil the life of the wood especially the hosts of chattering parrots, and last but not the least the multitude of fleas which made our nights miserable. All these were things to be remembered if not enjoyed, the fleas enjoyed our company anyway. Still another interesting experience was a trip in a stern wheel steamboat down one of the coastal rivers and then in a launch along the "Mar Pequeño" a great coastal lagoon similar to those in Florida. A week's sojourn in an old town at its outlets with a trip across the tumbling surf of its bar out on the South Atlantic. The sun scorched, at times the tropical rains beat down, the mosquitos sucked and the fleas bit, the food or rather the cookery was at times unspeakable, but the kindliness and hospitality of the people were always perfect. The scenery matchless of its kind and it was with a feeling very much akin to home sickness that I said goodby or "Ate-lago"—(so long) to my very kind friends on the Rio wharf and saw first their figures then the city and last of all the "Sugarloaf" glide away from me and disappear as the good ship Andes steamed out of the harbour and headed North along the Brazilian Coast to Bahia, Parnambuco, Madeira, Lisbon, Vigo and Southampton. These were all ports of call and on the evening of the 18th day we ran into dirty old London and heard English if not good Canadian spoken all about us. A week in London and I boarded the Canadian "Spinner" and after a two week's very comfortable voyage sighted my first Canadian land and Canadian snow at Chebucto head after an absence of four and a half months.

H. K. Wicksteed, M.E.I.C.

OBITUARY

Aubrey Granger Robb, M.E.I.C.

In the death of Aubrey Granger Robb, M.E.I.C., which occurred at Amherst, N.S., on June twentieth, from blood poisoning, the City of Amherst loses one of her foremost sons and the engineering profession one of its notable mechanical engineers.

AUBREY GRANGER ROBB, M.E.I.C.

The late Mr. Robb was in his fifty-first year of age, being born at Amherst on the fourth day of October in the year 1870. He was a son of the late Alexander Robb, one of the pioneer industrial builders of Amherst, who established and carried the Robb Engineering Works through the trying and momentous times from their early inception in 1865, until his death some twenty-five years later. In the year 1891 the deceased returned to Amherst from the Massachusetts Institute of Technology, where he studied mechanical engineering, and took up the designing of engines in the Robb plant, later becoming chief engineer and superintendent, and holding those important positions to the present time. In 1906 he served on Town Council board, his mechanical knowledge permitting him to give the town valuable service as a member of the Water Committee. In 1909 he won a spirited mayorality contest and served as Mayor during that year. For a number of years he occupied the position of secretary of the Maritime Branch of the Canadian Manufacturers' Association. In addition to these prominent and useful positions in the civic, industrial and commercial life of the community, Mr. Robb filled an important place in musical and social circles. As a musician he was a member of the Amherst military band, during the period of its early fame, and his excellent cornet playing has graced the programme of many a local concert. As one of the originators of the "Thirteen Club," and a sportsman of ability, particularly in the realms of angling and boating, he attained a popularity among his fellow citizens that might well be envied. He was an enthusiastic and capable yachtsman, being the holder of a coast navigator's certificate, and a member of the Nova Scotia yacht squadron, possessing the right to fly the British blue ensign on his sturdy craft the "Bras d'Or."

The deceased is survived by his wife, Lavenia Grace, daughter of Rev. Dr. Steele, and two children, Kathleen Courtenaye, and Victor Graham; also by a sister, Margaret A. MacGregor, widow of the late Rev. D. MacGregor, and two brothers, David W., late Manager of the Robb Engineering Works, and Walter R. of California.

Speaking of the late Mr. Robb, the Amherst Daily News pays a tribute to his memory in an editorial. "From his early youth he took a great interest in boy movements in town, and the old Y.M.C.A. had in him one of its most enthusiastic supporters. His fine musical ability naturally led him to membership in the band, and from this to orchestras of various kinds, culminating in one recently organized by himself out of the young talent in St. Stephen's Church; he gave liberally of his time and his talent to the upbuilding of the musical life of the town. In his own particular sphere, as chief mechanical engineer for the old Robb Engineering Co. and later for the International Engineering Works, he proved his competence and from a personal standpoint no one could be more popular with the men.

Always cheerful, always well groomed, always busy, without any wish for fame, he was one of our boys, who was a credit to his home, to his school, and a splendid asset in manliness and usefulness to the whole community. His life could be emulated with profit by many, for it was a wholesome, manly life, free from extremes, and governed by ideals of usefulness and service."

PERSONALS

E. H. Pacy, A.M.E.I.C., is now with the Pittsburgh Welding Company, Pittsburgh, Pa.

*

P. R. Phillips, A.M.E.I.C., has been appointed assistant engineer, at Birtle, Man.

*

Lieut.-Col. H. C. Lott, A.M.E.I.C., recently left England to resume his duties in Mesopotamia.

*

H. A. Elgee, M.E.I.C., has been appointed junior deputy chief engineer, Back Bay Reclamation Scheme Bombay, India, and has left for India.

R. S. C. Bothwell, A.M.E.I.C., has been appointed superintendent of Construction at the Canadian Johns-Manville Co. Ltd. of Toronto, Ont.

*

R. F. Davy, A.M.E.I.C., has been transferred from the Ottawa River Storage to the new dry dock now being constructed at Victoria, B.C.

*

K. P. Macpherson, A.M.E.I.C., has been transferred by the Northern Electric Company Ltd. to their Toronto branch.

*

A. M. Reid, S.E.I.C., recently accepted a position with Barber-Wynne-Roberts & Seymour, consulting engineers, for the summer.

*

A. W. Hanks, J.E.I.C., has resigned from the Dominion Bridge Co. Ltd., Winnipeg, Man. and is now with John A. Patterson, general contractors, in the same city.

*

A. B. Richardson, A.M.E.I.C., has moved from Toronto and is now with the Canadian Bridge Company Limited at Walkerville, Ont.

*

Geo. R. Elliott, A.M.E.I.C., has left The Canmore Coal Company Limited to take a special course in mining engineering at Columbia University, in New York.

*

Major George B. Hull, A.M.E.I.C., who left Canada to take up irrigation work for the British Government is now district irrigation officer, Euphrates Division, Baghdad, Mesopotamia.

*

Geo. D. Macdougall, M.E.I.C., has been appointed chief engineer of the British Empire Steel Corporation. For the past three years Mr. Macdougall has been general superintendent of the Nova Scotia Steel and Coal Company.

*

C. E. Macdonald, A.M.E.I.C., has resigned from the International Nickel Company of Canada Ltd., for which company he was sales manager for several years to take the position of manager with the Electrical Alloy Company at Toronto, Ont.

*

C. H. Scheman, A.M.E.I.C., general manager of the company formerly known as the Canadian Chicago Bridge and Iron Company, Limited, advises a change in the firm name to The Horton Steel Works, Limited. Bridgeburg, Ontario. Considerable interest is attached to the new name in view of the fact that it was adopted by the officers of the company in honour of Horace E. Horton, a pioneer engineer who did much to advance the engineering profession and who was founder of the business.

Mr. Horton died in nineteen hundred and twelve at the age of sixty-nine years. In a memoir prepared by Onward Bates, Hugh L. Cooper and Arthur L. Mason, for the Transactions of the American Society of Civil Engineers it states: "One of his striking qualities in his engineering practice was his universal refusal in middle life to accept anything he had previously designed, as a standard for the future. Every new contract for a bridge, and there were many, required an entirely new set of drawings to bring out new ideas of main and detailed designs, and in this sort of work he seemed to find great pleasure. The fact that in his later life he originated and perfected to a fine success the water tank with the hemispherical bottom that is now so generally used, and that he maintained this design as a standard over a term of years, during which time he built some twenty-four hundred of these tanks,was a great surprise to those who knew him between eighteen hundred and ninety and nineteen hundred. One of Mr. Horton's personal characteristics, that was very rare among men of his ability and always in evidence with him, was his great patience with a student employee who was trying to better his condition through special studies after hours and through special hard work during working hours."

BRANCH NEWS

Moncton Branch

M. J. Murphy, A.M.E.I.C., Secretary-Treasurer.

Honours for Member of Moncton Branch

Fred. H. Williams, M.Sc., A.M.E.I.C., who was among those upon whom the degree of Master of Science was conferred by McGill University on Monday, June 13th. 1921, was born at Knowlton P.Q. on June 6th. 1879 and educated at Knowlton Academy, where he obtained his A.A.

In 1903 he entered McGill University in the Faculty of Science, taking the Electrical Engineering course and graduated in 1907, obtaining his degree of Bachelor of Science. During the course he was successful in winning the Fleet workshop prize and first prizes in the following subjects;- Mechanical Draughting, Freehand Drawing and Lettering. From 1907 to 1910 he was an assistant engineer in the Engineering Department of the Northern Electric & Manufacturing Co. Montreal, P.Q.

From 1910 to 1912 Mr, Williams was with the Illinois Traction Co., Decatur Illinois, U. S. A., and from May 1912 to April 1918 was with the Montreal Tramways Company as Engineer in charge of special work.

From April 1918 to date he has been with the Engineering Department of the Canadian National Railways, Moncton N.B.

It was during this latter period that Mr. Williams obtained his degree of Master of Science. He entered nto the study of electric welding from a technical standpoint, in conjunction with his work at the Moncton shops. During this research work he assembled and equipped a laboratory of his own for the carrying on of the work at his home.

FRED. H. WILLIAMS, M.Sc., A.M.E.I.C.

Mr. Williams has read two papers on electric welding illustrated with lantern slides; one at the Halifax General meeting in October 1920, and which was published in the November number of *The Journal*; the other paper was read before our own Branch at one of the first meetings of the same, this was also illustrated with a much larger set of slides.

Mr. Williams assures us that he is going to carry on with his research work and we one and all wish him further success, and take the opportunity to congratulate him on the recent honour that McGill University has seen fit to confer on him.

St. John Branch

Harry F. Bennett A.M.E.I.C., Secretary-Treasurer

The Canadian Air Board films were exhibited before the members of the Branch and their friends at a special meeting in the Imperial Theatre on Wednesday evening June 29th. The theatre was very kindly placed at the disposal of the Branch for this purpose and the pictures were greatly enjoyed by those present.

Before the presentation of the pictures, the Chairman Frank P. Vaughan M.E.I.C. welcomed the visitors and introduced W. Rupert Turnbull, M.E., who has closely associated with the aircraft production in Great Britain during the war. Mr. Turnbull spoke of the advances which were made in aircraft design, of the necessity for rapid development and production during the war and the ultimate superiority of the Allied planes over those of the enemy. His explanations of the various types and their distinctive features added greatly to the exhibition.

University Recognition of Engineers

Banquet in honour of

Dr. Thompson,
Dr. Duggan,
Dr. Ross,
Dr. Fairbairn,
June 24th, 1921.

In the past the honorary degrees granted by Universities have generally been confined to the profession of law, medecine and theology, and when conferred outside these limits the recipients have usually been members of University faculties. The University of Toronto, however, has recently conferred the honorary degree of Doctor of Science on R. A. Ross,M.E.I.C. and J. M. R. Fairbairn, M.E.I.C. thus making four engineers to be so recognized, the former two being T. Kennard Thompson, M.E.I.C., of New York and G. H. Duggan, M.E.I.C., All these gentlemen graduated from the Ontario School of Practical Science, now the Faculty of Applied Science and Engineering of the University of Toronto, and have become leaders, not only in the engineering profession, but as citizens. Dr.Duggan and Dr.Ross are both Past Presidents of *The Engineering Institute of Canada*. Dr. Fairbairn is the present presiding officer, and Dr. Thompson has long held office in leading engineering bodies of the United States.

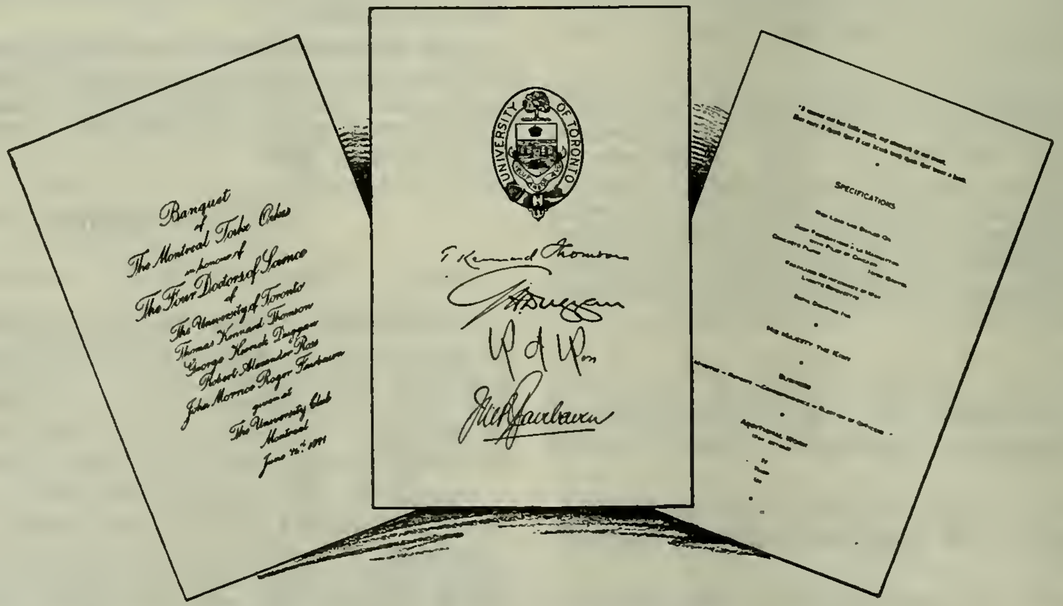
The Montreal Branch of the Engineering Alumni of the University of Toronto, known as "The Montreal respects to their four fellow graduates, and, on the Toike Oikes", embraced the opportunity to pay their evening of June 24th, at the University Club they were joined by a number of their friends at a banquet, nearly 100 being present, representing the leaders in all the faculties.

The chair was occupied by J. M. Robertson,M.E.I.C., President of the Toike Oikes, who, after formally receiving the reports of the officers, gave place to Harold Rolph, M.E.I.C.,the newly-elected President. Walter J. Francis, one of the Past Presidents of the Toike Oikes, and Vice-President of *The Engineering Institute* acted as Toastmaster.

The Toast to the King was received with enthusiasm.

The Toast "It" the University of Toronto, was ably proposed by Arthur Surveyer, M.E.I.C., one of the governors of the University of Montreal in a very eloquent tribute, and was appropriately responded to by the Rev. R. W. Dickie, M.A.

Toastmaster Francis then proposed "Them", and in doing so asked the gathering not to remember the wonderful month of June as one of the heat and mosquitos, but one of brides and Doctors of Science, and referring to the characteristics of "Them", said that Dr. Thompson might be likened to one who conceives the idea in a big way, Dr. Duggan to one who materializes it, Dr. Ross to one who magnetizes it with the spirit of life, and Dr. Fairbairn to one who operates and perpetuates it. The Toast was received with unbounded applause. Dr. Thompson in responding recalled the old days, expressed his appreciation of the honour, and told a number of very humorous stories and incidents. Dr. Duggan, with appropriate dignity, expressed his pleasure and thanks, referring specially to the honour done to the profession as a whole by the University. Dr. Ross bubbled over with enthusiasm and humour and kept his hearers in laughter, while Dr. Fairbairn spoke of the importance of the engineering profession



Banquet
of
The Montreal Toike Oikes
in honour of
The Four Doctors of Science
of
The University of Toronto
Thomas Kennard Thomson
George Herrick Duggan
Robert Alexander Ross
John Morrice Roger Fairbairn
given at
The University Club
Montreal
June 24th 1921

T. Kennard Thomson
G. H. Duggan
J. M. R. Fairbairn

Specifications

Menu Complimentary Banquet in honour of Dr. Thompson, Dr. Duggan, Dr. Ross, Dr. Fairbairn.

and of its place beside the other learned professions. Each of "Them" was received with an appropriate cartoon thrown on the screen.

The Toast "Us" The Toike Oikes was eloquently proposed by Prof. C. M. McKergow, A.M.E.I.C., of McGill University, and responded to by Mr. Rolph, who expressed the pleasure of the Montreal Toike Oikes in honoring their fellow members, three of whom were Past Presidents of the body.

Montreal Branch

J. L. Busfield, A.M.E.I.C., Secretary-Treasurer.

Although the activities of the Montreal Branch have been curtailed during the summer months, the various committees have been actively carrying on their work, and it is expected that the programme for next season will be one of unusual importance and interest.

Two important events of great interest to engineers occurred in Montreal during the past few weeks. One of these was the banquet tendered by the Montreal Toike Oikes to the four Doctors of Science of the University of Toronto, a full account of which is given elsewhere in this issue of *The Journal.*

Another event of great interest was the visit of the members of the Montreal Branch to the concrete sewer work under construction at Longueuil for the Inter-Municipal Sewer Construction Committee.

As the guests of the Canada Cement Company Limited, The Independent Concrete Pipe Company Limited and The Canadian Lockjoint Pipe Company Limited, a number of members of the Montreal Branch spent a very interesting day recently.

The party assembled at the Windsor Hotel and was driven over by motor car to the plant between St. Lambert and Longueuil where the pipe, a specimen of which was tested later in the day, is being manufactured. The special features of the pipe, which is being laid jointly by the municipalities of St. Lambert and Longueuil was explained briefly by W. G. Chace, M.E.I.C., and the party was given an opportunity to note the joint details.

The party was then taken by ferry and car to the Montreal East plant of the Canada Cement Company, where after luncheon the specimen 48″ concrete pipe was tested. The test was abandoned after fifty thousand pounds had failed to do more than start minute cracks. The joint test indicated nineteen thousand pounds breaking load, considerably over contract strength. Following the test the party made a brief inspection of the plant of the Canada Cement Company.

Peterborough Branch

D. L. McLaren, A.M.E.I.C., Secertary-Treasurer.

A meeting of the executive committee of the Branch was held on July 8, 1921 and the following committees were appointed, the first named being the convenor in each case:—

Committee on Legislature:— Messrs. Jas. Mackintosh, B. L. Barns and A. P. Miller.

Membership Committee:—Messrs. P. P. Westbye, A. L. Killaly, B. L. Barns and D. L. McLaren.

Meetings & Papers Committee:—Messrs. E. R. Shirley, R. L. Dobbin, H. O. Fiske and R. H. Parsons.

Messrs. R. L. Dobbin and E. R. Shirley were appointed as a committee to make the necessary arrangements for an outing for the members of the local Branch within the next month.

Toronto Branch

F. B. Goedike, A.M.E.I.C., Secretary-treasurer.

Messrs. J. M. R. Fairbairn, M.E.I.C., President of *The Engineering Institute of Canada* and R. A. Ross, M.E.I.C., Past President *E. I. C.* were the guests of the past and present members of the Executive Committee of the Toronto Branch E. I. C. at a luncheon at the National Club, Toronto, on Thursday June 9th on the occasion of their recent visit to Toronto to receive honorary degrees from the University of Toronto.

The Chairman of the Branch, G. T. Clark, A.M.E.I.C., proposed the toast of "Our Guests" which was responded to by Mr. Fairbairn who, in a few well chosen words, thanked those present for the honour done him. Mr. Ross, also responded and in his inimicable style kept the party amused with a fund of good stories.

In the evening Messrs. Fairbairn and Ross received the degree of Doctor of Science in Engineering conferred upon them by the University of Toronto in recognition of the eminence they have attained in the engineering profession.

Annual Report of the Toronto Branch, E.I.C.

Presented April 28, 1921,

To the Chairman and Members.
Toronto Branch E.I.C.

Gentlemen:-

I herewith beg to submit my report for the past fifteen months, covering the period since the last Annual Meeting held by the Branch on January 22nd, 1921.

During this period the Branch held forty-one general Branch meetings, this compares with eighteen meetings held during the preceding fifteen months. In addition to the regular meetings, there were a number of excursions arranged for the members to visit engineering works of special interest.

The Executive Committee during the same period held twenty-one meetings, at which the ordinary business matters of the Branch were transacted.

Many special Committees were appointed and were active during the past year. These have been enumerated in the report submitted at the Annual Meeting of the Institute held in February last.

The Library of the Toronto Branch was extremely fortunate this year in receiving a most valuable gift from Mr. Frank Moberly of the Public Works Dept. This gift consisting of the complete set of the Transactions of the American Society of Civil engineers bound in half-morocco leather, from the year 1903 to date.

Financial statement submitted shows a balance on hand of $159.64

Hamilton Branch

W. F. McLaren, M.E.I.C., Secretary-Treasurer

The Hamilton Branch E.I.C. held their March meeting in the Royal Connaught Hotel at 8.15 P.M. on March 23rd, 1921, H. U. Hart, M.E.I.C., Chairman, presided. The attendance was very good.

J. W. Tyrrell M.E.I.C., gave a report of the Town Planning Convention held in Toronto at which he was the delegate representing the Hamilton Branch. He reported that the convention would be held in Hamilton next year. A vote of thanks was tendered Mr.Tyrrell for his report.

A unique feature of the meeting was the presentation of a $25.00 cheque to John R. Dunbar, S.E.I.C., by Mr. Hart. This was the prize given by *The Engineering Institute* for the best student paper for the year 1920.

James J. MacKay, O.L.S., M.E.I.C., a member of the Town Planning Commission and also a member of the Wentworth Suburban Road Commission gave a splendid address on "Roads and Boulevards and what they Mean to Hamilton". Mr. MacKay showed maps to illustrate his remarks and described fully the different classes of roads and who were responsible for same. He showed a well worked out system of driveways, parks and boulevards for a greater Hamilton and comprising all the territory from the Red Hill on the East to the Guelph escarpment on the West and taking in the North shore and Beach on the North. An interesting discussion followed, short addresses being given by the following gentlemen:—

Dr. Mullins representing the Hamilton Health Association, Mr. Rae representing Flamboro Township, T. S. Morris representing the Town Planning Commission, R. K. Palmer, G. C. Martin and others.

A vote of thanks was tendered to Mr. MacKay for his splendid paper and the Secretary was instructed to secure a synopsis of same and have it sent to the Journal for publication.

Annual Meeting

The Annual Meeting of the Hamilton Branch of *The Engineering Institute of Canada* was held in the Royal Connaught Hotel on May 6th, 1921 at 8.15 P.M.

H. U. Hart, M.E.I.C., Chairman, called the meeting to order and gave a short resumé of the year's business showing that material gains had been made in all branches of activity. He expressed his thanks to the chairmen of the different committees for their good work and cooperation during the year and referred especially to the good work of Mr. Dwight, Chairman of the Papers Committee in securing good meetings for the year.

The Secretary's report was read by J. A. McFarlane M.E.I.C., and showed increases in receipts and membership.

The Treasurer's Report was referred to the auditors.

On motion Messrs. Paulin and Darling were appointed Auditors to report at the final meeting.

Mr. Dwight reported very fully for the Papers Committee and outlined several papers which could be secured by the incoming executive.

E. R. Gray A.M.E.I.C., reported for the Legislation Committee. He stated that the Engineers' Bill was given its second reading in the House, and in the Committee opposition arose which was formidable enough to cause postponement of the Bill until next session.

The Nominating Committee according to the by-laws was elected and asked to report to the Executive as early as possible. Scrutineers were also selected to report at the final meeting.

The advisability of dividing the Branch into sections was discussed at some length and it was decided to leave this over to the new Executive for their consideration.

The question of *The Engineering Institute* taking a greater interest in civic affairs was discussed. It was felt that engineers should take an active part in the work of such boards as Town Planning Commission, Board of Education, Board of Health, etc. A committee was selected to investigate into this question and report at the October meeting.

The Nominating Committee made report to the Executive on May 16th and the ballot was returnable on the 30th of May. A ballot revising the Branch by-laws to allow juniors to vote was also issued at the same time returnable for the final meeting of the season which it was decided to hold on May 30th.

Final Meeting of Season

The final meeting of the season took the form of a luncheon in the Arcade Tea Rooms at 12.30 noon on May 31st., Mr. Hart, Chairman, presiding. There was a very good attendance.

The Auditor's report was read and adopted. This report showed a balance on hand on May 30th of $144.80.

Short addresses were given by Messrs. Hart, McKay, Tyrrell and others.

The scrutineers announced the result of the ballot as follows:—

Honorary Chairman:—Robert Hobson, M.E.I.C.
Chairman:—H. U. Hart, M.E.I.C.
Vice-Chairman:—E. H. Darling M.E.I.C.
Secretary-Treasurer:—W. F. McLaren M.E.I.C.

Committee:—W. G. Milne A.M.E.I.C., one year, J. W. Tyrrell M.E.I.C. one year, H. Graham Bertram M.E.I.C., two years, F. W. Paulin A.M.E.I.C., two years.

Ex-Officio:—R. K. Palmer M.E.I.C., E. R. Gray, A.M.E.I.C.

The above names were declared members of the Executive Committee by the Chairman.

The by-law allowing Juniors to vote was declared carried.

A vote of thanks was passed by the meeting to the retiring members of the Committee.

Roads and Boulevards and what they mean to Hamilton

James J. MacKay, M.E.I.C., O.L.S.,

Member of The Town Planning Commission and The Wentworth Suburban Road Commission

Gentlemen:

When I was first asked to speak to you on some phase of Town Planning, as it was considered that you would be interested in the subject, especially as relating to Hamilton, I naturally hesitated about consenting to do so as I am not a public speaker, but as Town Planning has been a hobby of mine for some years and as I never let a chance slip to boost for Hamilton and its improvement, I consented to do so. I was somewhat in the position of the man from Los Angeles. At the Ontario Good Roads Convention held in Toronto last week, one of the speakers from California prefaced his remarks by telling a story to show that a Californian never missed an opportunity to boost for his home town. A man who lived in one of the centres died. As he had no relatives or friends to look after any funeral arrangements,a group of neighbours thought that it was only right that the man should have a decent burial. The funeral was accordingly arranged and while they stood around the coffin and before lowering it, the spokesman suggested that it only seemed right and fit that someone say a few words about the deceased. There was silence for some time, no one volunteering to say anything. The man from Los Angeles spoke up and said,"As there appears to be no one who wishes to speak about the deceased, I would like to say a few words for Los Angeles."

I think that we Hamiltonians could very reasonably adopt this man's example and boost for Hamilton.

Town planning is a very large subject, taking into consideration as it does every phase of civic development. It does not simply mean the laying out of new streets and subdivisions as is the popular impression, but embraces a study and planning of a city's sewage and water system, its streets, suburban and steam railway systems; its municipal buildings, its schools, its factory, business and residential districts, its parks and boulevards, in fact, everything that goes to make a great city all come under the scope of Town Planning and I do think that it is wise economy for every town and city to have prepared a comprehensive Town Planning scheme so that they will be developed along right lines and not grow up in a hap-hazard way, poorly laid out, narrow streets where they should be wide, factory and dwelling mixed indiscriminately, poor railway facilities, inadequate water and sewer systems and various other things which happen when no comprehensive system is being followed.

In thinking over what might be of the most interest to you and having just come from the Annual Convention of the Ontario Good Roads Association, held in Toronto, it struck me that I might talk to you on "Roads" and what they mean to Hamilton. The Department of Public Highways, under whose jurisdiction practically all roads are administered, leaving out city streets, have designated six different systems of roads.

1. Township Roads
2. County Roads
3. Provincial County Roads
4. Provincial Suburban Roads
5. Suburban Area Roads
6. Provincial Highways

All these systems receive government aid for their construction and maintenance.

The Township Road. 80% is borne by the Township and 20% by the Province. County Roads. 60% is borne by the County and 40% by the Province. Provincial County Roads. 40% is borne by the County and 60% by the Province. Provincial County Suburban. 20% by the County, 20% by the City and 60% by the Province. Suburban Area Roads. 30% by the County, 30% by the City and 40% by the Province. Provincial Highways. 20% by the County, 40% by the Provincial and 40% by the Federal Government. As said before, there is no government aid in the construction of streets within the limits of a city or incorporated town.

Many of you may not be aware that seven Provincial Highways enter the City of Hamilton. These Highways are -

1. Main Street East from Hamilton to Niagara Falls.
2. Caledonia Road from Hamilton to Caledonia and Port Dover.
3. Ancaster Stone Road from Hamilton to Ancaster, Brantford and on to Windsor.
4. The Hamilton and Dundas Stone Road from Hamilton, through Dundas to Galt and Kitchener.
5. Town Line Road from city limits through Clappison's Corners, Freelton and on to Guelph and Owen Sound.
6. Dundas Street from Clappison's Corners easterly through Waterdown to Toronto
7. Toronto and Hamilton Highway.

These roads are built and maintained under Government supervision and receive, as stated above, the most liberal grants. They will all be of a permanent type of construction, such as concrete like the Toronto and Hamilton Highway, Warrenite or other bituminous surface materials like, the Dundas and Ancaster Stone Road.

The county roads connect up with the Provincial Highways and form a regular network of roads leading to every part of the County and connect with similar systems in the adjoining Counties.

The suburban area roads are those very heavily travelled roads in the immediate vicinity of Hamilton. These roads are under the jurisdiction of the Suburban Area Commission, a commission of five members, two of which are appointed by the City of Hamilton, two appointed by the County of Wentworth and a fifth appointed by the Provincial Department. The cost of these roads as I said before, 30% is paid by the City, 30% by the County and 40% by the Province.

You will thus see that Hamilton is a hub of a perfect network of highways reaching out from the City in every direction into the surrounding districts, enabling the country people to come into the city with their produce with the least amount of inconvenience and also enabling the tired city dweller, be he business man or workman, to hie himself and family in his flivver out into the country to enjoy the clear, fresh air and beautiful scenery which surrounds Hamilton on every side.

Coming closer into the city, I would like to describe to you some of the schemes which have been suggested towards making Hamilton an ideal city. A number of these are pet schemes of my own and naturally they seem all right to me and I hope they will appeal to you also.

For instance, we have our city parks, Harvey, Dundurn, North End or Eastwood Park, the Stewart Park, Canal Reserve Park, Wabasso Park or Oaklands Park. Just see how easily it would be to connect up all these parks with a regular boulevard system. You can leave Dundurn Park via Tecumseh Street to Barton Street, to Bay, to Burlington Street and along Burlington Street Eastward touching Eastwood and Stewart parks, divert to Beach Road at Ghent's Crossing to keep alongside the Radial Railway to Beach Road proper, thus avoiding all the various railway crossings. Thence along the Beach Road to Brant's Pond, passing through the Canal Park, then along the North Shore Boulevard to Wabasso and Oaklands Park and back into Harvey Park via York street. Think what a drive that would be if the City only planned this as a comprehensive boulevard scheme, make provision for widening the roadway to a proper width, planting trees along both sides and in addition have a civic street car line following this route and entirely circling the Bay. It would only be necessary to bridge the gap from Burlington to the cemetery on York Street, along the North Shore and we would have one of the finest boulevard drives in Canada, connecting up seven city parks and having a view of the waters of the bay throughout practically its entire length.

At this point it might be well for me to describe to you the new Valley Inn entrance scheme. This scheme consists of five bridges linked up with a roadway between. That is, a bridge over the C.P.R. and Grand Trunk over what is known as the London Branch, a bridge over the Grand Trunk at the Junction Cut, these two bridges being within the City limits have to be financed by the City and Railway companies. Bridge No. 3 is over the old channel leading to Coote's Paradise. A fourth bridge over the Grand Trunk main line and the fifth bridge over the Waterdown Road and crossing from the East side of the Grand Trunk Railway to the hills just West of the Hendrie Farm. The last three bridges are being constructed by the Provincial Highway Department with a contribution from the City of Hamilton. You will thus see that this scheme eliminates all the bad features in the vicinity of the Valley Inn in order to get to either Toronto, Waterdown or Clappison's Corners and should be a large factor in the development of this section of the immediate vicinity of Hamilton.

Hendrie Memorial Park

While I am speaking about this section, I would like to point out the great possibilities of the Hendrie Valley as an ideal park. All the broken land in the vicinity of the Valley Inn and leading through the Hendrie Valley is ideal for park purposes. The stream which comes down through Waterdown and through the Valley could very easily be widened and deepened to enable boats to come from the Bay right into the heart of the Valley. At the present time there are winding roads leading up from the Valley with the hillsides beautifully wooded and every condition favorable for a most wonderful park system and this park also would be on the boulevard drive before referred to.

Mountain Face Park

You are, no doubt, aware that the city for some time past has been acquiring practically the whole face of the mountain from Chedoke Ravine Eastward, past Ottawa Street and just last year the City employed Messrs. Cauchon and Dunnington Grubb to develop a system of driveways and parkways for this Mountain Face Park and a start was made early last Fall towards constructing one of these drives, having a 3% grade and leading from Charlton Avenue up the face of the Mountain and coming out on Sherman Avenue. When this scheme is completed we shall have one of the most magnificent parks in America.

Red Hill Valley Park

I have suggested for a number of years that the City should acquire the valley of the Red Hill Creek from the Lake Front to Van Wagner's Beach southward to Rosedale and ending at Mount Albion Falls. This section is another natural park, having a winding stream running throughout its length, with wooded hillsides, ample grounds for recreational purposes of all kinds and a commanding lake frontage. Every important highway leading Eastward from the city would land you in this park. The Beach Road would land you at the upper end, Burlington Street, Barton Street, Britannia Avenue, Cannon Street, Roxborough, Dunsmuire, Main, Maple Avenue and King Street all lead directly into the park so that in this way the park would be available for the entire Easterly district of Hamilton. Your can see that Hamilton has an opportunity of having one of the most park schemes that anybody could desire.

Pipe Line Boulevard

You doubtless have heard and read in the local papers the scheme of opening up the Pipe Line as a boulevard. The Pipe line, as you know, runs in a diagonal direction Northeasterly from the intersection of Main and Ottawa Streets to the pump house at the Beach. Originally this was a thirty-three foot right of way for the water pipe bringing the water supply in the City of Hamilton. For some years past we have been working to the end of having a width of sixty-six feet thirty-three feet to be provided on the South side of the original pipe line right of way. This has now been accomplished and the idea is to have a broad thoroughfare running diagonally from the crossing at Main and Ottawa Streets to the Beach along this route. This is going to give much more rapid communication to the Northeasterly district than at the present time.

Forty Mile Boulevard

Another boulevard which has been proposed, would start say at Wentworth Street and follow the Mountain Brow Boulevard Easterly through the City Park, following the Mountain Brow Road Southerly to Mount Albion. Then following the existing roadway and certain proposed diversions along the East bank of the Red Hill Valley Park before mentioned, to a junction with the Van Wagner's Beach Road just East of the filtering basins. We will then follow the Beach Road Northerly as previously described to Burlington and along the North Shore Boulevard to the Valley Inn Bridge scheme at the Town Line Road, follow the Town Line Road to where it intersects what is known as the old "York Road" which leads from Dundas to Watertown at the foot of the Mountain. We would follow this York Road Westerly into Dundas joining the Provincial Highway at Dundas. We would then follow the Provincial Highway back towards Hamilton to the Junction of the Ancaster and Dundas Roads at Binkley's Hollow; then following Southward along the Horning Mountain Road until we reach the top of the Mountain, where we would join the proposed Mountain boulevard, following the brow of the mountain Eastward through the Sanitorium property, Calquhoun property, coming out onto Fennel Avenue at Garth Street. Thence through the asylum grounds to the Mountain drive road, between upper James Street and the head of the Hamilton and Barton Incline, down the John Street Mountain Road to Strongman's Road, up Strongman's Road, to Concession Street, along Concession Street and Wentworth Street to where we began at the head of the Wentworth incline. This driveway, as you will see, entirely circles the City of Hamilton and Hamilton Harbour so that a view is obtained of the City from every direction and I venture to say that no city in Canada would have a driveway which would be comparable with this one.

I have endeavoured in this short talk to give you a general outline of some of the schemes which are proposed for the beautification of Hamilton and which, if carried out, would be one of the greatest advertising features that Hamilton could possess and would undoubtedly mean a great deal in the future growth of Hamilton, making it an ideal city to live in and in which to do business.

Sault Ste. Marie Branch

F. T. Gnaedinger, Jr. E.I.C., Secretary-Treasurer.

The annual dinner of the Sault Ste. Marie Branch of *The Engineering Institute of Canada* was held at the Country Club on the evening of June 28th. Covers were laid for forty. The guests of honour were J. M. R. Fairbairn, M.E.I.C. President of *The Engineering Institute of Canada* and chief engineer of the Canadian Pacific Railway, and Fraser S. Keith, General Secretary of *The Institute.* A distinguished gathering of prominent men representing the leading industries and occupations of the Sault enjoyed this opportunity of meeting together as guests of the local Branch of *The Institute.* Among those present were:—

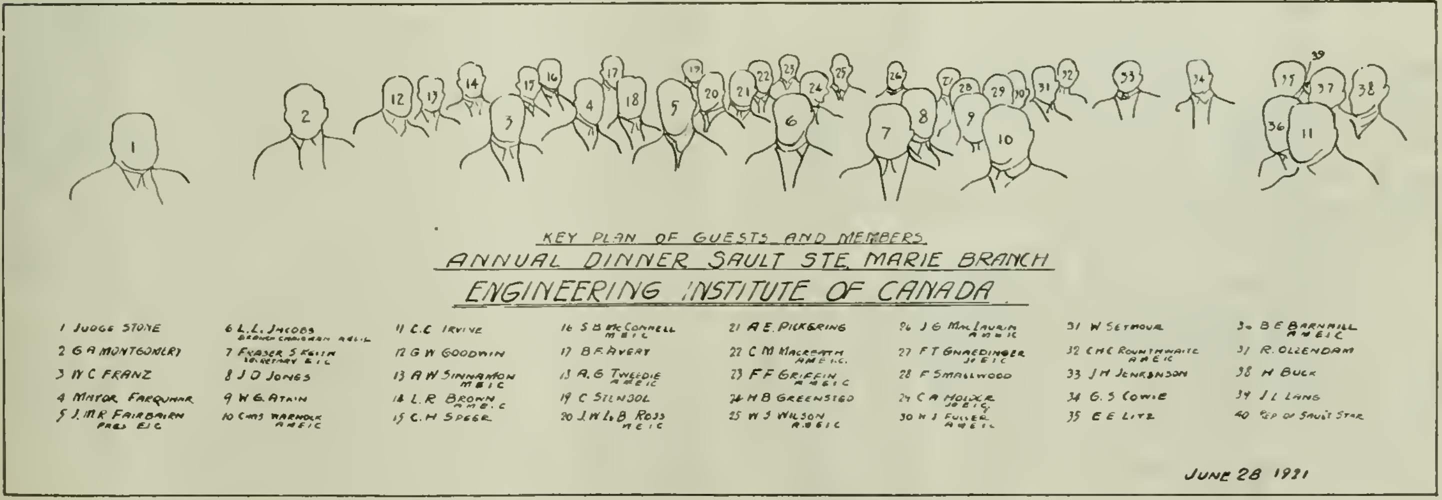
Messrs. W. C. Franz, J.D. Jones, C. C. Irvine. Judge Stone, Mayor Farquhar, G. W. Goodwin, Chas. Warnock, W. G. Atkin, G. A. Montgomery, R. Olzendam, Wm. Seymour, H. B. Greensted, A. E. Pickering, C. H. Speer, B. F. Avery, C. Stenbol, J. H. Jenkinson, G. S. Cowie, E. E. Litz, S. B. McConnell and others.

The following members of the local Branch were present: Messrs. B. E. Barnhill, L.R. Brown, H. Buck, W.J. Fuller, F. T. Gnaedinger, F. F. Griffin, G. W. Holder L. L. Jacobs, C. M. Macreath, J. G. McLaurin, J. W. LeB. Ross, C. H. E. Rounthwaite, A. W. Sinnamon, F. Smallwood, A. G. Tweedie and W. S. Wilson.

During the course of the evening several speeches, interspersed with musical numbers, contributed to the enjoyment of all present. With C. H. Speer at the piano Miss Edith Speer sang "Morning" by Oley Speaks, and for an encore "The Banjo Song" by Homer, and was warmly applauded. Miss Helen Myers' violin selections, "Lieberfreud" and the "Old Refrain" by Kreisler, were also given an enthusiastic reception. Before the close of the entertainment Miss Speer and Miss Myers were each presented with a bouquet of roses by the Chairman of the Branch, L. L. Jacobs. A.M.E.I.C.

Mr. Fairbairn, in a short interesting address, talked on the results of the organization of *The Institute* upon the engineering profession. He stated that it had raised the status of the individual members, put engineering "on the map" and in general had raised the dignity of the

SAULT STE. MARIE DINNER



whole profession. Touching upon the new so-called "100 pound" standard rail which is being rolled for the C. P. R. by the Algoma Steel Corporation, he outlined the work of the committee on standards of the American Railway Engineer's Association and pointed out the benefits to be derived from such work.

W. C. Franz, President of the Algoma Steel Corporation, emphasized the great part that engineers have played in the history of the Sault, and remarked upon the large number of very high-class engineers connected with the steel and paper industries of this District.

The Relationship of Engineering to the Community was the subject of a short address by Judge Stone. He pointed to the Sault as an inspiring example of the founding and maintaining of a modern community by the untiring efforts of engineers to utilize the resources of the District. He spoke of the building of the Ship Canal; the development of the St. Mary's River Rapids for electrical power; the conception, erection and operation of the large industries here; the construction of the A.C.R.; the utilization of the products of mine and forest,as all combining to show the nobility of the profession, the members of which, he said, properly belonged to a high plane in society.

Representing the Spanish River Pulp and Paper Company, C. C. Irvine referred to the extreme importance of the various branches of engineering to the paper industry, and mentioned specific instances of what the application of engineering skill had accomplished for it.

Crown Attorney Goodwin provided most of the laughs of the evening in his usual inimitable manner. He was followed by Mayor Farquhar who spoke shortly on municipal affairs. For the information of the out-of-town guests he mentioned among other things that the city of Sault Ste.Marie had 10 miles of paved streets, 45 miles of sanitary and storm sewers, its own self-supporting water and light systems, 17 schools with about 4,500 pupils and 21 churches.

Fraser S. Keith, our genial General Secretary, then addressed the gathering upon the aims and activities of *The Institute*, and drew attention to the increased interest which is being taken in it throughout the whole of Canada. The evening's entertainment was then brought to a close by the singing of God Save the King.

Annual Meeting June 30th. 1921

The third annual meeting of the Sault Ste. Marie Branch of *The Engineering Institute of Canada* was held in the Algoma Steel Corporation Board Room, the Cornwall Building, on the evening of June 30th. 1921.

L. L. Jacobs, A.M.E.I.C., the retiring Chairman, was in the Chair. Upon calling the meeting to order he announced the election of the following Officers and Committees for the ensuing year:—

Chairman :—K. G. Ross, A.M.E.I.C.,

Vice-Chairman:—B. E. Barnhill, A.M.E.I.C.,

Secretary-Treasurer:—F. T. Gnaedinger, Jr.E.I.C.

Executive Committee for one year:—C. H. E. Rounthwaite, A.M.E.I.C., J. G. McLaurin, A.M.E.I.C L. R. Brown, A.M.E.I.C. For two years:—J. W. LeB. Ross, M.E.I.C.,F. F. Griffin, A.M.E.I.C., L. L. Jacobs, A.M.E.I.C.

Papers and Publicity Committee:—W. S. Wilson, (Chairman),A.M.E.I.C., A. W. Sinnamon, M.E.I.C., G. H. Kohl, A.M.E.I.C., J. W. LeB. Ross, M.E.I.C., W. J. Fuller, A.M.E.I.C.

Legislation and Remuneration Committee: — A. G. Tweedie, (Chairman), A.M.E.I.C., B. E. Barnhill, A.M.E.I.C., G. H. Kohl, A.M.E.I.C., C. H. E. Rounthwaite A.M.E.I.C..

Membership Committee:—L. R. Brown (Chairman), A.M.E.I.C., G. H. Kohl, A.M.E.I.C., L.H.Derrer, S.E.I.R. W. J. Fuller, A.M.E.I.C.

Entertainment Committee:—L. L. Jacobs (Chairman A.M.E.I.C., A. G. Tweedie, A. M.E.I.C., J. G. McLAUrin, A.M.E.I.C.

Nominating Committee:—J. W. LeB. Ross (Chairman), M.E.I.C.,W.S.Wilson, A.M.E.I.C., L.R. Brown, A.M. E.I.C.

Before yielding the Chair to his successor Mr. Jacobs thanked the officers, committees and members of the Branch for their support during his term of office. It was due to their efforts that he could look back over the past year as being one of the most interesting and successful in the history of the Branch.

B.E. Barnhill, Vice-Chairman, then took charge of the meeting in the absence of the newly-elected Chairman, K. G. Ross. The report of the retiring Secretary G. H. Kohl, was read and adopted. The Papers Committee reported a successful year. During the past season the following papers were read before the Branch.

Oct. 26th. 1920:—C. H. E. Rounthwaite, A.M.E.I.C., History of Engineering In and Around the Sault.

Dec.2nd. 1920 L. L. Jacobs, A.M.E.I.C., and H. Buck, M.E.I.C.,—Purchasing Methods and Procedure.

Jan. 26th. 1921 G. L. Durgin,:—Decay in Timber.

March 3rd. 1921 Wm. Seymour:—Oxidation of Coal in Storage.

March 24th. 1921 B. E. Barnhill, A.M.E.I.C., Cause and Effects of an Explosion at a Blast Furnace.

April 28th. 1921 Spanish River Pulp and Paper Co. Moving Picture, Spruce to Newsprint.

May 26th. 1921 G. S. Cowie:—Mining and Mining Methods in Algoma.

The Legislation and Remuneration Committee's report was read by F. F. Griffin, A.M.E.I.C. They recommended the adoption by the Branch of the Salaries Schedule of the Toronto Branch of *The Institute* with the addition to the Industrial Schedule of Field Engineers. Instrumentmen, Chainmen and Rodmen. The same rates should apply to them as to similar grades in the Municipal Schedule. The present situation with regard to Provincial Legislation was commented upon.

The report of the Membership Committee was then read and adopted. C. H. E. Rounthwaite A.M.E.I.C., in reading the report drew attention to the awakened interest in *The Institute* and the Local Branch. This was due to a large extent to the canvassing done by members of the Committee and to the very successful missionary work done at the Annual Dinner held earlier in the week. A number of applicatioms for membership in *The Institute* was the result of this campaign.

B. E. Barnhill, A.M.E.I.C., read the report of the Committee on the Annual Dinner, turning over monies in hand and outstanding accounts to the Secretary for settlement. It was generally conceded that the dinner had been a great success in every way and a hearty vote of thanks was tendered to the Committee for their work in connection with it.

The meeting then adjourned. The next regular meeting will be held on the last Thursday in September. In the meantime the various committees will have met and prepared their programmes for the next season.

Saskatchewan Branch

D. A. R. McCannel A.M.E.I.C., Secretary-Treasurer.

W.R.Warren A.M.E.I.C., chief engineer, Saskatchewan Department of Telephone and Chairman of the Saskatchwan Branch of the *E. I. C.* has left for an extended business trip through eastern Canada and the United States.

H.N. Macpherson A.M.E.I.C. of Regina has entered the bridge contracting business and is at present constructing two reinforced concrete bridges for the Saskatchwan Department of Highways.

July 27th has been set as the date for voting on the supplying of water from the Saskatchwan River for the cities of Moose Jaw and Regina and the intervening territory. Lt-Colonel A. J. McPherson A.M.E.I.C. Chairman of the Water Supply Commission has been busily engaged for the past few weeks explaining the proposal by addressing public meeting.

C. E. Malone Jr., M.E.I.C. who has completed his third year at Queen's University has accepted a position as instrumentman for the summer with the city engineer's department Regina.

C. J. Mackenzie M.E.I.C., professor of civil engineering, University of Saskatchewan, Saskatoon, has left for the East where he will spend the summer months. Professor Mackenzie has been one of the most active members of the Saskatchwan Branch particularly in connection with the investigations into the effect of alkali on concrete.

The A. G. McVean Co.Ltd. (H. G. McVean M.E.I.C.) president and manager) have been awarded the contract for a new school in Regina the contract amounted to approximately $110,000.00

L. A. Thornton M.E.I.C. city commissioner, City of Regina has been appointed a member of the Commission of Inquiry into the Equalization of the Public Revenue Tax which is now holding sessions throughout the Province.

Lt-Colonel A. C. Garner D.S.O., M.E.I.C. chief engineer Land Titles Department, Province of Saskatchewan has been forced to leave for a short stay at Banff Alta., to take a rest and medical treatment. Lt-Colonel Garner as chairman of the papers and library committee has had charge of the arrangements for the Western Professional Meeting in Saskatoon, August 10th, 11th, and 12th and has personally been largely responsible for successfully completing the preparatory details for the meeting. He expects to return in time for the meeting and during his absence the work of the committee is being ably directed by D. W. Houston A.M.E.I.C.

W. R. W. Parsons M.E.I.C. of the Parsons Engineering Company Regina expects to leave in the near future for Toronto where he will reside.

W. H. S. Richardson (capt) Jr. M.E.I.C. late of the G. T. R. Valuation Department has accepted a position with the Canadian National Railways at Regina.

J. W. D. Farrell Jr. M.E.I.C. assistant superintendent of waterworks, City of Regina, is expected to return to Regina with his bride from Los Angeles, Cal., U.S.A. about the end of July. To Mr and Mrs. Farrell the Branch extends its best wishes and congratulations.

Vancouver Branch

C. Brakenridge A.M.E.I.C., Secretary-Treasurer.

When on a recent visit to Vancouver, A. D. Swan, M.E.I.C. of Montreal, consulting engineer for the Ballantyne Pier in course of construction for the Vancouver Harbour Commission, donated twenty-five dollars for a book prize to be competed for by the student grade of this Branch.

The subject chosen is "Town Planning in relation to Vancouver".

The Vancouver Branch has moved to Room 510 Board of Trade Building.

This Branch has a very good reference library which has been further added to through the kindness of Charles Garden, M.E.I.C. who has presented several valuable engineering books and reports.

Mr. Garden has recently left Vancouver for Woodstock, N.B.

Limiting the size of the City

H. L. Seymour, A.M.E.I.C

NOTE—*In order to make this column of wide interest to members of The Institute, personals and items of town planning interest will be appreciated Address: H. L. Seymour, A.M.E.I.C. 40 Jarvis Street, Toronto.*

Limiting the size of the City

That the size of a city can, or should be limited, is a matter that has been little considered by most engineers. But it surely is a matter of some importance. The garden city idea is probably as old in its conception as town planning but it is only receiving real consideration in the last few years just as is town planning.

What are the advantages of a large city and what are its disadvantages? In a recent paper on the Paris Town Planning competition Prof. A. Barrington of The University of Toronto makes the statement that a city of 20,000 people can offer all the amenities that the average person can take advantage of. In the last analysis we must admit that our efforts should be directed towards the attainment of the ideal of the greatest happiness for everyone. The writer submits that large cities are not conducive to the best happiness.

It is not intended here to inquire into ways and means but to raise the question as to whether or not it is desirable that the size of a city should be artificially limited. But if the city has power to acquire and maintain parks it also could conceivably control the use of land around the built-up portion to be used, as in the case of English Garden Cities, only for agricultural purposes. This becomes easier as the principles of the city planning and of zoning for certain prescribed uses become recognized. The tendency of modern times is apparently towards decentralization of industry giving rise to "Satellite Cities". The attention of municipal engineers should be directed to the problem of limiting the size of cities. Opinions will of course vary, but a number of well planned small cities with breathing spaces between seem to offer many advantages over one large mass of struggling humanity living in a city that has grown without particular planning and absorbed in its growth various suburbs that might better have existed as separate units.

A Town Planner's Library

In the May issue of *The Journal* a list of books recommended by the Town Planning Institute of Canada was given. For ready reference these might be repeated:–

The Planning of the Modern City—By Nelson P. Lewis (E.I.C. Library 971-L67).
Town Planning in Practice—By Raymond Unwin.
Rural Planning and Development—By Thomas Adams, Commission of Conservation Report.
Introduction to Landscape Architecture—By Professor Hubbard and Theodora Kimball.

There are many books, of course, that might be added to this list and many of the public libraries now carry them. The following are a few suggestions:—

The Case for Town Planning—By H. R. Aldridge.
Practical Town Planning—By J. S. Nettleford.
Cities in Evolution—By Patrick Geddes.
Ancient Town Planning—By F. Haverfield.
Mediaeval Town Planning—By F. T. Tout.
The Garden City—By C. B. Purdom.
New Towns after the War, —By New Towsnmen, (the above published in England).
City Planning—By C. M. Robinson.
City Planning—By John Nolen.
Re Planning Small Cities, by John Nolen.
New Ideals in the Planning of Cities, Towns and Vilages,—By John Nolen,
Satellite Cities, G. R. Taylor,
Principles of City Land Values, — By R. M. Hurd, (the above published in United States).

Magazines

The Town Planning Review,
The Garden Cities and Town Planning Magazine (the above published in England)
The American City (City Edition)(E.I.C. Library)
The National Municipal Review
(the above published in United States)
The Journal of the Town Planning Institute of Canada (the above published in Canada)

Convention of Anglo-Saxon Chemists

Final arrangements have been made for the Annual Meeting of the Society of Chemical Industry to be held in Montreal during the week of August 29th. On this, the first occasion on which the Annual Meeting of the parent society of Great Britain has been held in Canada, many of the most eminent chemists of the world will be gathered together.

The overseas delegation will be headed by Sir William Pope D.Sc., F.R.S., K.B.E., etc.

Other prominent figures of the party include Dr. Louis A. Jordan, Chevalier of the Crown of Italy, F.I.C., A.R.C.Sc., etc. whose work as a member of the British Mission on Explosives to the Italian government is well known; Dr. Andrew Smith, managing director of the firm of Leech, Neal and Co. Limited; Dr. C.J.Goodwin of the firm of Oscar Goodwin and Sons, explosives engineers.

Dr. Frederick William Atack whose principal work has been the chemistry of dyes, and to whom we are indebted for the excellent translation of Professor Wahl's "Manufacture of Organic Dye Stuffs", will also be present. Dr. Atack also organized the publication of the Chemists'' Year Book, which is now in its sixth edition.

The steel industry will be represented by Dr.Andrew McWilliams C.B.E., A.R.S.M., whose experience in the management of Steel Works coupled with scientific researches have earned him a notable among steel metallurgists.

Dr. C. S. Garland, the pioneer manufacturer of thorium nitrate will also be a visitor.

Dr. Frederick William Gamble, director of Allen and Hanbury's Limited and professor J. W. McBain are accompanying the party.

Among the notable visitors from the United States will be Dr. W. A. Noyes, professor of chemistry of the University of Illinois and past president of the American Chemical Society; Dr. Charles Herty, editor of Industrial and Engineering Chemistry; Dr. W. H. Nichols, president of the Allied Chemical and Dye Corporation.

There will be a general gathering of chemists from every portion of the Dominion of Canada.

The principal feature of the opening session will be the address of the retiring president Sir William Pope, which will be followed by the introduction of the president elect, Dr. R. F. Ruttan.

The succeeding two days will be confined to technical papers and discussion at both the morning and afternoon sessions.

The annual banquet of the Society will be held at the Windsor Hotel on the evening of Tuesday August thirtieth.

The Montreal programme will conclude with a special convocation at McGill University, followed by a garden party which will be given by the ladies of Montreal.

On leaving Montreal the visitors will be the guests of the Shawinigan section of the Society, where every facility will be afforded them for the inspection of the many interesting industries which have grouped themselves around Shawinigan Power development.

From Shawinigan Falls the party will proceed to Ottawa thus giving the Ottawa chemists opportunity of adding their welcome.

Leaving Ottawa Friday night the guests will arrive at Toronto the following morning where the itinerary will include a visit to the Canadian National Exhibition. An opportunity for rest will be afforded during Sunday at Niagara, followed by inspection of plants around the Falls. At noon on Monday the party will cross the International Bridge and become the guests of the American Chemical Society, who have arranged a most excellent programme including visits to Buffalo, Syracuse, to New York via the night line down the Hudson River. At New York opportunity will be afforded them of meeting the members of the New York Section of the Society of Chemical Industry. The guests will then be privileged to attend the annual meeting of the American Chemical Society the banquet of which will be held on Friday evening. The following two days will be devoted to sight seeing and such rest as may be thought desirable to enable the visitors to enjoy the National Exposition of Chemical Industries which opens on the week of September the twelfth. This exposition is unique and forms a fitting climax to the tour.

Preliminary Notice

of Applications for Admission and for Transfer

27th July 1921

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate member a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in August, 1921.

FRASER S. KEITH, Secretary.

The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

DAVIS—GEORGE SANFORD, of Montreal, Que. Born at Cincinnati, Ohio, Nov. 28th, 1874; 1894-1902, with various companies, in Cincinnati, Niagara Falls, New York and Shawinigan Falls on electrical repairs, mtce and constrn.; 1902 (Apr.-Dec.), foreman, experimental dept.,Pittsburg Reduction Co., Niagara Falls,N.Y.; 1902-04, in charge of switchboard constrn., Shawinigan Water & Power Co.; 1904-05, supt. of constrn., Albion Power Co.; 1905 (Mar.-Nov.), in charge of temporary lighting and power, Ontario Power Co.; 1905-1920, constrn. supt., specializing in switchboards, generators and high tension transformers, Can. General Electric Co.; August 1920 to date, electrical engineer, J. M. Robertson, Montreal, Que.

References: J. M. Robertson, J. C. Smith, L. A. Herdt, R. S Kelsch, F. T. Kaelin, W. H. Wardwell, H. W. Fairlie, J. Baxter.

DONALD—JAMES RICHARDSON, of Montreal, Que Born at Montreal, Oct 1890; Educ., B.A., B.Sc., McGill Univ.1913; Before grad., chem. engr'g. work, Truro Condensed Milk Co Ltd , Huntingdon Belgo-Canadian Pulp & Paper Co Ltd ,Shawinigan, Canada Starch Co Ltd ; 1913-14, chemist, Nichols Chemical Co. Ltd., Sulphide, Ont.; 1914-15, gen. consltg with J. T. Donald & Co Ltd.; 1916-18, chief insp'r., explosives and chemical in Canada, for Ministry of Munitions. Special report on inspection and manufacture of explosives, Great Britain, 1918; 1919-21, chem engr and chief chemist, Canadian Packing Co. Ltd , Toronto; At present, consltg. chem. engr.,J. T. Donald & Co. Ltd.

References: N.P.Dalziel, F. B. Brown, L. M. Arkley, W. Chipman, F. S. Keith, R. J. Durley, W. J. Francis, J. C. Kemp.

EDWARDS—GORDON MAXWELL MEIGHEN, of Ottawa, Ont Born at Perth, Ont., July 1st, 1898; Educ.,B.Sc.,1920, M.Sc., 1921, McGill Univ ; 1916 (4 mos.), Instr'man., G.T.R., Ottawa Divn.; 7 mos. 9th Seige Bty., C.E.F , St John, N.B.; 1920, 3 mos. transitman for Montreal Engr'g. Co. at Chelsea, Que., 1 mos. recon. survey, for Riordon Co., 1 mos. trail smelter.

References: E. Brown, H. M. MacKay, H.M.Lamb, J. B. Porter, C M. McKergow.

EMSLIE—PETER, of Montreal, Que. Born at South Alloa Scotland, June 6th, 1881; Educ., Science course (3 years) Perth Academy., Dundee Technical College (1 year); 1896-99, pupil with Jas. Smart & Son, Arch't and Surveyor, Perth; 1899-1902, draftsman and outside supervision for James Sibbald, A.M.I.C.E., Dundee; 1902-04,private practice, Dundee; 1905-07, draftsman under works engr., Cox Bros. Ltd., Jute & Hemp Mfrs., Lochee; 1907-09, mgr .,Dundee Branch, Ollendorff & Clarkson, Ltd., Scotland, engrs. and agents for reinforced concrete and fireproof systems; 1909-20 (with exception of active service), with Currie & Co. Ltd., Bldg. Trade Merchants, Lime Mfrs. & Mine Owners, Scotland, as branch manager and technical advisor for cement and other bldg. materials; 1918-19, mapping dftsman. on gen. staff hqrs. lines of communication, Royal Engrs., France; April 1920 to date, with J. M. Robertson, M.E.I.C., Consltg. engr., Montreal, as res. engr. in charge of erection of cotton mill, St. Hyacinthe, and power house and power plant installation, Montreal.

References: J. M. Robertson, J. T. Farmer, W. I. Bishop, J. M. Begg, H. W. Fairlie, L. A. St. Pierre, E. L. Lyons, J. Baxter.

FAULKNER—CHARLES FREDERICK PETER, of Victoria, B.C. Born at St. Albans, Herts., England, June 29th, 1888; Educ., Heriot Watt College, Edinburgh. Prof. C. E. Prov. of B.C.; 1906-09, (summers) workshop training, James Milne & Sons Ltd., Edinburgh; 1910, transitman & and draftsman with G. H. Broughton, C.E., B.C.L.S., Penticton, B.C.; 1911-14, with A. I. Robertson,B.C.L.S., Victoria, B.C., 18 mos. in charge of parties in field, and 1 year in charge of dfting office; 1914, assisting in design of new acid plant, Victoria Chemical Co.; 1914-18, overseas. Lieut.; 1918 to date, with C.N.R. in charge of the laying out and constrn. of the Victoria Terminals.

References: D. O. Lewis, D. McMillan, H. L. Johnston, E. F. Cooke, H. M. Bigwood, K. M. Chadwick.

HAGARTY—BERTRAND, of Winnipeg, Man. Born at Portage la Prairie, Man., May 25th, 1879; Educ., 3 years engr'r., Univ. of Manitoba. Prelim. M.L.S. and D.L.S. ,Intermediate M.L.S.; Member, Assn. of Prof. Engrs. of the Prov. of Man.; 1898-99,asst. on right of way and constrn. work, C.N.R.; 1910-13, instr'man and res. engr., T.C.RY.; 1914, res. engr. on rly. and asst. on power site, Winnipeg River Power Co.; 1915, instr'man and res. engr., Hudson Bay Rly.; 1916-17 and 1919, asst. on Dom. Govt. Surveys; 1918, res. engr. on mtce., G.T.P.; 1920, asst. engr., Grand Trunk Valuation, Dept. of Rlys. and Canals. At present not employed.

References: E. E. Brydone-Jack, G. F. Cairnie, T. B. Campbell, M. C Macfarlane, V. Michie, J. G. Sullivan.

HAMILTON—JOHN BROWN, of Estevan, Sask. Born at Bellshill, Scotland, March 31st, 1892; Educ., Royal Technical College, Glasgow. Cert. of the Inc. Sanitary Assn. of Scotland. Ap'ticed to mech. engr'g., including experience in mach. shop; fitting and erecting shop, elect'l and drawing office experience, G. Russel & Co., Crane Bldrs., Motherwell Scotland; 4 years (1912-15), asst. sanitary engr. and insp'r., Burgh of Motherwell, Scotland; During War was asst. insp'r., Aeronautical Inspection Directorate, Great Britain for about 4 years (1915-19). Rank, Lieut.; 1919-20, asst. plant mgr., Messrs. Harland & Wolff, Belfast, constrn. of new plant. Also carried out the constrn., erection and tests of the Super Handley Page 1500 H.P. aeroplanes built by this firm; At present town engr., Estevan.

References: D. A. R. McCannel, J. N. deStein, I. F. Roche, W. Chipman, J. Hamilton.

HARDING—SIDNEY, of Regina, Sask. Born at Greenwich, England, Jan. 27th 1881; D.L.S.; 1902-04, rodman, C.N.R.; 1905, leveller and transitman, G.T.R.; 1906, res. engr., G.T.R.Ry.; 1907-10 and 1919, rld and irrig. constrn. by contract; 1911, res. engr.,G.T.P.Ry.; 1912-17, in charge of party making townsite and right of way surveys under direction of E. C. Brown, D.L.S. with the G.T.P.Ry.; 1918, making plans and computations in connection with proposed hydro-electric power plant for C.P.R. under direction of S. E. Junkins Co. of Vancouver; 1920, with Parsons Engineering Co. of Regina, making surveys and supt'ing constrn. of rural highways; At present partner in above firm. Municipal engr'g works, surveys, etc.

References: L. R. Ord, A. J. Gayfer, J. A. Heaman, J. N. deStein, J. L. R. Parsons, W. R. W. Parsons, F. P. Wilson.

HAWKES—HORACE HENRY, of Grand Mere, Que. Born at Bournemouth, Hampshire, England, March 14th, 1886; Educ., 1902-04, unfinished electr'l course, Hartley University College, Southampton, England; 2 yrs tramways constrn., Bournemouth Municipal Tramways; 1907-08, car draftsman., C.P.R., Angus shops; 1908-09, struct'l draftsman, G.T.P.Ry., Montreal; 1909-10, steel car drafstman, Dominion (Canadian) Car & Foundry, Montreal, Que.; 1910-19, detailer, checker and estimator, Dominion Bridge Co., Lachine; March 1919 to date, struct'l designer, Laurentide Company, Grand Mere.

References: F. B. Brown, H. O. Keay, D. C. Tennant, J. J. O'Sullivan, J. A. Jamieson.

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*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option, Railway, Municipal, Hydraulic, Mechanical, Mining or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects, Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits scientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

JOHNSON—HAMMOND, of Bienfait, Sask. Born at Charlottetown, P.E.I., March 20th, 1892; Educ., B.Sc., McGill Univ., 1915; 1912, P.E.I. provincial surveys; 1913, timekpr. and representative for McKinnon & Holmes, Sherbrooke, in struct'l. steel erection for Intercolonial shops at Moncton; 1914, drafting for above firm in Sherbrooke, also supting. erection of reinforced concrete bridge at Cardigan, P.E.I.; 1915-19, overseas, C.F.A.; Feb. 1919 to date, asst. engr. with the Lignite Utilization Board in Ottawa, Montreal and Bienfait.

References: R. A. Ross, R. DeL. French, L. R. Thomson, E. Stansfield, G. R. MacLeod, I. F. R. Roche, C. M. McKergow, H. M. Lamb.

LENNOX—JOHN GEORGE, of Lachine, Que. Born at Glasgow, Scotland, August 29th, 1890; Educ., 1904-11, engr'g subjects, Royal Glasgow Tech. College; Aprticeship with Sir Wm. Arrol & Co. Ltd., Glasgow, as follows, 1904-06, drawing office, 1906-08, fitting, erecting and machine shops, 1908-11, drawing office; 1911-14, detailing, designing and supervising outside erection of mech., elect'l. and struct'l work, with above firm.; 1914-17, leading draftsman, Herbert MorrisLTD., Loughborough, on lifting and conveying mach. of all types;1917-19, designing and estimating on all types of cranes, steelworks plant etc., Sir Wm. Arrol & Co. Ltd., Glasgow; 1919-20, designing special cranes and opening up new dept., Armstrong & Main Ltd.; At present design and estimating, mech. dept., Dominion Bridge Co. Ltd.

References: F. P. Shearwood, F. Newell, R. H. Findlay, T. A. Chubb, C. E. Herb, K. O. White.

LITZ—EARL EWING, of Sault Ste Marie, Ont. Born near Lincoln Center, Kansas, May 31st, 1878; Educ., 1899-1902, student Univ. of Colorado; 1902, sec. and mgr., Home Coal Oil & Gaz Co., Boulder, Colorado; 1903, assayer, Porter Reduction Co., Boulder, Colo.; 1905-12, employed by the Henry L. Doherty Syndicate with offices in New York, as follows: 1905, industrial gas engr., Pueblo, Colo., 1906, industrial gas engr., Union Gas & Elect. Co., Cincinnati, 1908, combustion engr., Combustion Utilities Corpn., and 1909, pres. and mgr. with same firm. President and mgr. Allentown Brick Co., Director, Glen-Gary Brick & Cement Co., also Pres. and mgr. of the following,New York & New Jersey Brick, Co., Earl E. Litz., Saxton Vitrified Brick Co., Saxton Coal Co.,; 1917, combustion engr., Illinois Steel Co., Jan. 1920 to date, combustion engr., Algoma Steel Corpn. Ltd.

References: A. W. Sinnamon, B. E. Barnhill, F. F. Griffin, LeR. Brown, L. L. Jacobs, R. S. McCormick.

MERCIECA—ALBERT LEWIS, of Toronto, Ont. Born at Malta, Europe, March 1st 1880; Educ., Land Surveyor and Architect, Valletta, Malta, 1903. 2 years in struct'l steel and reinforced concrete, Toronto Technical School; 1900-03, pupil, P. W. D., Valletta; 1904-11, private practice in arch'tute and land surveying, Valletta; asst. engr. on dockyards and breakwater constrn., Valletta, with Pearson & Sons Ltd. (London, England); 1911-13, estimator, draftsman and instr'man., dept. of location, C.N.R., Toronto; 1913 to date, designer of transformer stations and general hydro development with H.E.P.C. of Ontario.

References: H.K. Wicksteed, F. F. Clarke, E. E. Wells, S. A. Lanzon, S. G. Smith, H. V. Armstrong.

PEARCE—WALTER RICHARD, of St. John, N.B. Born at Wallacetown, Ont., Jan. 21st, 1881; Educ., B.A., Queen's Univ., 1905. Four years student's course for grad. only with the Western Electric Co., Chicago, in telephoning engr'g.; 1909-21, with Alta. Govt. Telephones as follows: 1909-12, in direct charge of all outside plant etc., 1912, in charge of all engr'g constrn. and from 1914, also in charge of all depts. of the system; March 1921 to date, chief engr., N.B. Telephone Company.

References: R. S. L. Wilson, G. G. Murdock, F. G. Goodspeed, F. H. Peters, A. W. Haddow, B. L. Thorne, S. G. Porter, C. A. Robb.

SPEER—CHARLES HENRY, of Sault Ste Marie,Ont. Born at Richmond, Indiana, U.S.A., Dec. 21st, 1869; Educ., grad. St. Louis Manual Trainig School (equals Univ. matric.), 1887. 1890-94, served time as machinist, St Louis & Iron & Mach. Works on corless engines; 1894-98, draftsman, American Brake Co. (Westinghouse), St. Louis, Mo.; 1898-1901, master mechanic and engr., American Steel Foundries, East St. Louis, Illinois plant; 1901-05, draftsman., Cambria Steel Co., Johnston, Pa.; 1902-05, in charge as chief dftsman., engr'g dept., Lackawanna Steel Co., Buffalo, N.Y.; 1905-07, chief draftsman, Milliken Bros. Inc., New York City; Carr & Speer, Engrs., New York City, 1907-09; 1909 to date, with Algoma Steel Corpn., 1909-17. supt. constrn., 1917, purchasing agent, 1917, to date, works engr.

References: R. S. McCormick, R. U. Hart, C. H. Marrs, S. B. McConnell, R. E. Chadwick, A.Allaire, B. E. Barnhill, F. F. Griffin.

STENBOL—CARL, of Sault Ste Marie, Ont. Born at Askim, Smaalenene, Norway, Nov. 21st, 1881; Educ., Amer. School of Corres., Mech. engr'g. course; 1909-11, chief draftsman, Dom. Iron & Steel Co.; 1911-12, chief draftsman, Algoma Steel Corpn; 1912-14, smelter engr. and chief draftsman, Canadian Copper Co.; 1915 (Jan.-Sept.), designer, Anaconda Copper Co.; 1915 (Sept.-Nov.), mech. engr., Dome Mines Co.; Nov. 1915,chief engr. having full charge of design and building of a small steel and forge plant for the Canada Cement Co., Montreal.. Appointed supt. of steel and forge dept., same firm, June 1916, resigned when this plant shut down May 1917; Came to Sault Ste. Marie May 1917, as gen. mgr. of the Algoma Construction Co., then to be formed. Shortly afterwards transferred to the Algoma Steel Co. as asst. to the Managing director. Appointed mech. supt. of the Algoma Steel Corpn. Sept. 1917, which is present position.

References: D. H. McDougall, G. D. MacDougall, L. L. Jacobs, A. W. Sinnamon, LeR. Brown, F. F. Griffin, A. C. Tagge.

STRONG—ROBERT AMBROSE, of Bienfait, Sask. Born at Victoria, B.C., Oct. 7th, 1891; Educ., B.Sc., B.A. Univ. of Illinois, 1915; 1910-11, cost clerk, Studebaker Corpn., South Bend, Ind.; 1913 (summer), sampled mines for Peabody Coal Co., Illinois;1914 (summer), Illinois Mine Rescue Station; 1915-18, asst. chemist and metallurgist, Dominion Bridge Co., Lachine; 1918-19, overseas, Can. Engrs.; 1919 (May-Oct.), asst. foreman of copper refinery, Dominion Copper Products Co.; Oct. 1919 to date, asst. chem. engr., Lignite Utilization Board; At present acting chem. engr., for above concern.

References: R. DeL. French, R. A. Ross, I. F. R. Roche, E. Stansfield, L. R. Thomson, J. H. Bradley, H. H. Vaughan.

TURNER—JACK, of Grand Falls, Nfld. Born at St. John's, Nfld., Nov. 5th, 1889; Educ.,I.C.S. civil engr'g.; 1906, rodman, boundry survey, 1907-08, inst'man., paper mill constrn., Anglo-Newfoundland Development Co.; 1909, transitman, location, 1910-11, engr. on track, Reid Newfoundland R. R.; 1912-13, transitman on transcontinental highway (B.C. section) Cleveland & Cameron, Vancouver, B.C.; 1914, sub-contractor, Kettle Valley R. R., B.C.; 1914-19, overseas. Comm'd. Feb. 1917, Awarded M.C. April 1917; June 1919 to date, logging engr. and asst. to genl. logging supt., Anglo-Newfoundland Development Co., Grand Falls, Nfld.

References: C. S. L. Hertzberg, R. W. Powell, W. Scott, F. H. Balfour, J. W. Morris, F. W. Angel, J. B. Baird.

FOR TRANSFER FROM CLASS OF JUNIOR TO A HIGHER GRADE

FARRELL—JAMES WARDROPE DICK, of Regina, Sask. Born at Smith's Falls, Ont., Sept. 20th, 1890; Educ., B.A., 1912, B.Sc., 1915, Queen's Univ.; 1913-14 (summers), asst. to D.S. & E., Saskatoon highways dept.; 1914-19, overseas, Can. Engrs., and R.A.F. Capt. when demobilized; 1919-20, field and office draftsman, irrig. branch, Dept. of the Interior, Calgary; Jan. 1920 to date, asst. supt., Waterworks, Regina, Sask.

References: J. M. Mackay, L. A. Thornton, D. A. R. McCannel, A. N. Ball, I. R. Strome.

GARRONI—MELITON C., of Winnipeg, Man. Born at Island of Malta, Europe, Sept. 29th, 1888; Bach. of Engr'g and Arch'ture, Malta Univ., 1912; Member, Assn. of Prof. Engrs. of the Prov. of Man.; 1912-13, draftsman, C.C. Chattaway, L.S. and Engr.; 1913-14, draftsman, constrn. dept., C.P.R. Winnipeg; 1915 (Aug.-Nov.), draftsman, J. Chisholm, Arch't., Winnipeg; 1915-16, acct., constrn. dept., C.P.R., Winnipeg; 1916 to date, office engr. and draftsman, mtce. of way dept., C.N.R. Winnipeg.

References: A. V. Redmond, E. N. Johnson, N. M. Waddell, A. W. Smith, A. M. Macgillivray, E. R. Millidge, J. W. Porter, T. W. White.

GNAEDINGER—FREDERICK THEODORE, Sault Ste Marie, Ont. Born at Montreal, Que., Aug.2nd, 1889; Educ., B.Sc.(Met. Eng.), McGill Univ. 1912; Surveying,drfting and constrn. work during vacations; 1911 (May-Sept.), on operation of By-Product Recovery Coke Ovens, Algoma Steel Corpn., Sault Ste Marie, and May to July, 1912, constrn. work and field engr'g. for same company; 1912 (July-Dec.), dftsman and field engr., Lake Superior Paper Co. (now Spanish River Pulp & Paper Co.), Sault Ste Marie; 1913 (Jan.-Aug.), efficiency and production engr. for same company; 1913 (Sept.-Dec.), in charge of field party for hydro elec. dev. survey for Mond Nickel Co., and Jan. 1914 to July 1915, res. engr. on constrn. of dam and power house at Nairn Falls, Spanish River for same company; 1915-16, metallurgist and smelter supt. for New Brunswick Metals Ltd., mining and smelting antimony at Lake George, N.B.; 1916-19, overseas. Can Rly. Troops, Lieut.; Dec. 1919, asst. to A. W. Sinnamon, asst. chief engr. in charge of constrn. of new combination rail and struct'l mill, Algoma Steel Corpn. At present constrn. engr. with above company.

References: B. E. Barnhill, LeR. Brown, J. A. DeCew, W. L. Dethloff, W. Monds, B. Ripley, A. W. Sinnamon, A. Stansfield.

MILLER—WARREN CRON, of St. Thomas, Ont. Born at Point Edward, Ont., Feb. 12th, 1894; Educ., B.Sc., (Honours), Queen's Univ., 1917: Summer 1913, with C. F. Aylesworth, O.L.S., D.L.S., on resurvey of Dom. lands, Ericksdale, Man.; 1914-15, instr'man., on constrn. Trent Canal, Dept. of Rlys. and Canals; 1917-18, military foreman of works, military district No. 3; 1918-19, Lieut., Can. Engrs.; 1919 (July-Dec.), asst. city engr., and Dec. 1919 to date, city engr., St. Thomas. Ont.

References: T. S. Scott, J. A. Bell, W. F. M. Bryce, A. Jackson, R. R. Hepinstall, M. U. Ferguson, W. J. Shaw, Jr., F. A. Bell, J. Mackintosh, F. S. Lazier, R. A. McLellan.

O'DONNELL—JOHN GERARD, of Quebec, Que. Born at Quebec, Feb. 22nd, 1889; Educ., B.Sc.(Civil), McGill Univ., 1916; 1911 (4 mos.), rodman city engr's office, Quebec; 1912 (4 mos.), leveller on location, T. C. Ry.; 1913 (4 mos.), in charge of concrete piling work, constrn. of Can. Vickers Shipyard, Maisonneuve; 1913 (3 mos.), insp'r on bridge erection, C.N.R. for Can. Inspection Co.; 1914 (8 mos.), surveying and dfting city engr'g office, Quebec; 1916-18, with Imperial Ministry of Munitions as testing engr., Welland, asst. insp'r of steel in charge of Welland sub-district, asst. insp'r. of steel, Eastern sub-district, Montreal; 1918-19, chief insp'r., forging work, Canada Foundries & Forgings, Welland; 1919-20, asst. engr. in charge of wharf constrn. etc., under Ross Thompson, chief engr. Davie Shipbldg. Co., Lauzon, Que.; 1920 (Feb.-June), in charge of constrn. of shipways, track work and gen'l engr'g. work, National Shipbldg. Corpn., Three Rivers; June 1920 to date, engr. for the Jos. Gosselin Co. Ltd., Gen'l Contractors, Quebec. Estimating, designing and supt'ing work.

References: G. K. Addie, C. E. Gauvin, R. Thompson, W. D. Baillargé, I. E. Vallée, C. A. Buchanan.

ROSS-ROSS—DONALD DECOURCY, of Montreal, Que. Born at Montreal, June 23rd, 1896; Educ., B.Sc., (Mech.), McGill Univ., 1917; 2nd class Ontario Stationery Engr's. cert., 1920; Ont. Teacher's cert. for power plant engr'g.; Course in Industrial Engr'g.; 1916 (summer), Shell shop, Northern Electric Company; 1917-18, with Can. Navy, 1917-18, mate engr. and 2nd engr. officer, 1918 (Aug.-Dec.), engr. sub. lieut., and 2nd engr. officer, H.M.C.S. Niobe; 1919 (2 mos.), cable engr'g. officer, Northern Electric Co.; 1919-20, instructor in charge of the vocational training classes, in power plant engr'g., Toronto Technical School; July 1920 to date, industrial engr., planning dept., Canadian Consolidated Rubber Co., Montreal.

References: A. R. Roberts. C. M. McKergow, G. L. Stephens, M. B. Watson, R. L. Weldon, T. Eardley-Wilmot.

FOR TRANSFER FROM CLASS OF STUDENT TO A HIGHER GRADE

HICKEY—JOHN HOWARD, of Halifax, N.S. Born at Halifax, Nov. 25th, 1897; Educ., B.SC. (C.E.), N.S. Technical College, 1920; 1916, rodman, Foley Bros. Welch Stuart & Fanquier; One month ao'tice, Nova Scotia Steel & Coal Co.; 1918 (May-Sept.), asst. at Nova Scotia Tech. College, power house; 1919, rodman, land survey in Cape Breton; May 1920, to date, asst. engr., city engr's.office, Halifax.

References: F. W. W. Doane, F. R. Faulkner, H. W. L. Doane, G. S. Stairs, W. J. DeWolfe.

The Journal of The Engineering Institute of Canada

SEPTEMBER 1921 Volume IV, No. 9

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VOLUME IV MONTREAL, SEPTEMBER 1921 NUMBER 9

Tenth General Professional Meeting

Saskatoon, August 10th, 11th and 12th

Under the Auspices of the Branches of the Four Western Provinces.

Under ideal weather conditions and surroundings the Tenth General Professional Meeting of *The Institute* was opened in the new physics building of the University of Saskatchewan at 9.30 on the morning of Wednesday, August 10th, with George W. Craig, M.E.I.C., city engineer of Calgary, in the chair. Secretary Keith announced receiving a telegram from President Fairbairn in which he extended his cordial greetings to the meeting, and sincere wishes for its success, and regretted his inability to be present, due to illness. He, however, was looking forward to meeting the Western members at an early date.

In the absence of President Murray, George H. Ling, Ph. D. dean of the faculty of arts, and acting president of the University, extended a cordial note of welcome to the gathering, and expressed the pleasure it gave the University to provide quarters for such a gathering as this. On behalf of the City of Saskatoon, Mayor A. MacG. Young expressed his appreciation of the opportunity of meeting the Western members of *The Engineering Institute.* He announced that arrangements had been made whereby all delegates to the convention were tendered the privileges of the Saskatoon Club, the Riverside Country Club and the City Golf Club. Much to the disappointement of some of the delegates, he announced that, although a physician, he did not issue prescriptions.

At this point in the proceedings one of the outstanding features of the convention occurred, when, for possibly the first time in Canada, an audience was given an exhibition of the working of the audion, in being privileged to listen to an address of welcome from His Honour W. H. Newlands, Lieutenant Governor of Saskatchewan, seated at his desk in Regina, one hundred and sixty miles away. By means of the magnavox, with a megaphone attachment, his voice was clearly heard in all parts of the hall.

In part, Lieutenant Governor Newlands said "The development of the telephone and the gramophone make it possible for me to be present at several conventions at different points on the same day. To those of you who come from other provinces I extend a welcome to Saskatchewan. We have not in this province many engineering problems which you have in Alberta and British Columbia, because we have not the mountains to traverse. We have rivers, however, but any problems in connection with them have been solved by our men, as you will see by many fine bridges across the Saskatchewan river in Saskatoon. In this South country we have one problem which requires solution, and that is to make a satisfactory road for wet weather. The soil is too chalky to build them of material impervious to water, but we hope that you engineers will be able to devise something so that a road, when built, will remain passable in wet and dry weather. The transportation question, whether by road or rail, is to-day one of the most vital in Canada, and we look to our engineers and business men for a solution. In making those remarks, however, it is not for the purpose of making a speech, but for testing the magnavox. I hope your convention will be a successful one, not only to those present, but for the benefit of the whole country. (Loud and prolonged applause).

The Development of Trunk Highways as Affecting the Western Provinces

The first professional paper on the programme was "The Development of Trunk Highways as Affecting the Western Provinces" by C. W. Dill, M.E.I.C. superintendent of highways, Province of Saskatchewan. Mr. Dill, in introducing his subject, said: "This question of road building while perhaps of greater importance to the business and social welfare of the residents of the prairie provinces than any other, is one that has become worn almost threadbare through constant repetition, and it is difficult to introduce new, interesting matter. But being of such importance, and constantly brought to our attention, it is my firm belief that in spite of disappointments due to conditions difficult to control, and the more or less general apathy in the maintaining of the roads in a satisfactory, usable condition, we should persevere and do our utmost to awaken a more general interest in the value of good roads and their necessity. While attending the recent Halifax Good Roads Convention it was apparent that the Eastern provinces were more interested in types of roads much more expensive than we—with our long distances and sparse population, can afford to consider for many years to come. They are building trunk highways of a permanent nature for through traffic, and the increasingly heavy motor truck transport. We are chiefly concerned in building main market roads to enable our farmers to market their grain and other products as cheaply and as expeditiously as possible, and to give them means of social intercourse and pleasure without which life on the prairies is rather a colourless experience.

The assistance being given the various provinces by the federal government has enabled us to extend our work, and to develop highways parallelling the railways, forming main routes for business and tourist travel between the provinces, as well as to provide opportunities for our prairie residents for more extensive motor trips, whether they be for business or for pleasure. We as engineers have a duty to the public in developing this road building programme in such a way as to win their confidence and to prove our value as efficient public servants. With this idea in mind, a short paper has been prepared which will be presented as an introduction to the discussion on the development of trunk highways as affecting the Western provinces."

Mr. Dill then read his paper, published on page four forty one in the August Journal, following which H. S. Carpenter, A.M.E.I.C. deputy minister of highways for the Province of Saskatchewan, presented a progress report of the Committee on Standard Specifications for Highways. At the introduction of this report Mr. Carpenter made it clear that the report was not a unanimous one.

Report of Committee on Standard Specifications for Highways

Presented by H. S. Carpenter, A.M.E.I.C.

At the General Professional Meeting of the Western Branches of *The Engineering Institute of Canada* held, in August, 1918, at the City of Saskatoon, a committee was appointed "to draw up a standard road specification, including a road policy, and to report to the next Western Professional Meeting."

This committee was composed of J. D. Robertson, A.M.E.I.C., of Edmonton, now deputy minister of public works for the Province of Alberta, M. A. Lyons, A.M.E.I.C., of Winnipeg, chief engineer for the Good Roads Board for the Province of Manitoba, and H. S. Carpenter, A.M.E.I.C., of Regina, deputy minister of highways for the Province of Saskatchewan.

Progress Report

We regret to have to report on behalf of your committee that although some progress has been made through correspondence the committee has been unable to get together and prepare a final report on the matters submitted to it. The following material is submitted, therefore, in the form of a progress report with the hope that it will form the basis of a useful discussion on the matters dealt with, but your committee is not prepared to recommend the adoption of this report as embodying standards which should be adopted by this meeting of western engineers.

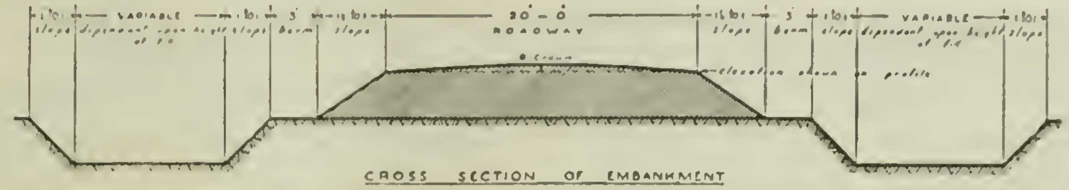
Your committee decided to deal with the question of roads as applicable to the three prairie provinces of Manitoba, Saskatchewan, and Alberta under the following general heads:—

1. Standard cross-sections for earth roads,
2. Standard specifications for the construction of earth roads,
3. Standard culverts and bridges for earth roads,
4. Suggested road policy to be adopted in the prairie provinces for the administration of the construction and maintenance of highways.

GOVERNMENT OF THE PROVINCE OF SASKATCHEWAN

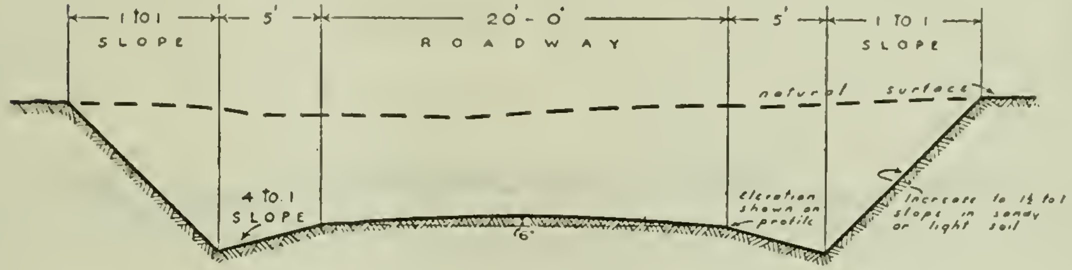
DEPARTMENT OF HIGHWAYS

Figure 1



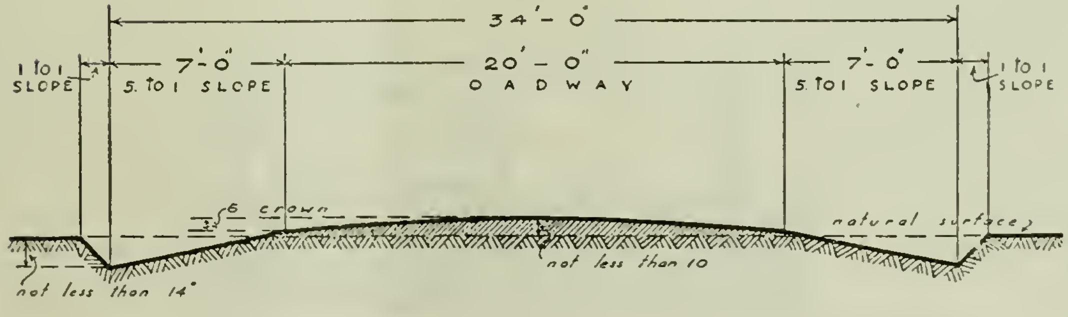
CROSS SECTION OF EMBANKMENT

Figure 2


1 to 1 SLOPE
5'
20'-0" ROADWAY
5'
1 TO 1 SLOPE
natural surface
4 to 1 SLOPE
6"
Elevation shown on profile
Increase to 1½ to 1 slope in sandy or light soil

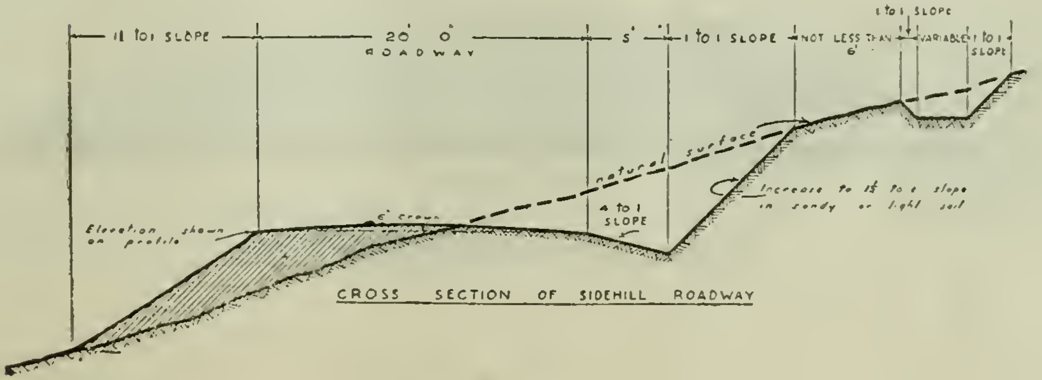
CROSS SECTION OF ROADWAY IN CUT

Figure 3



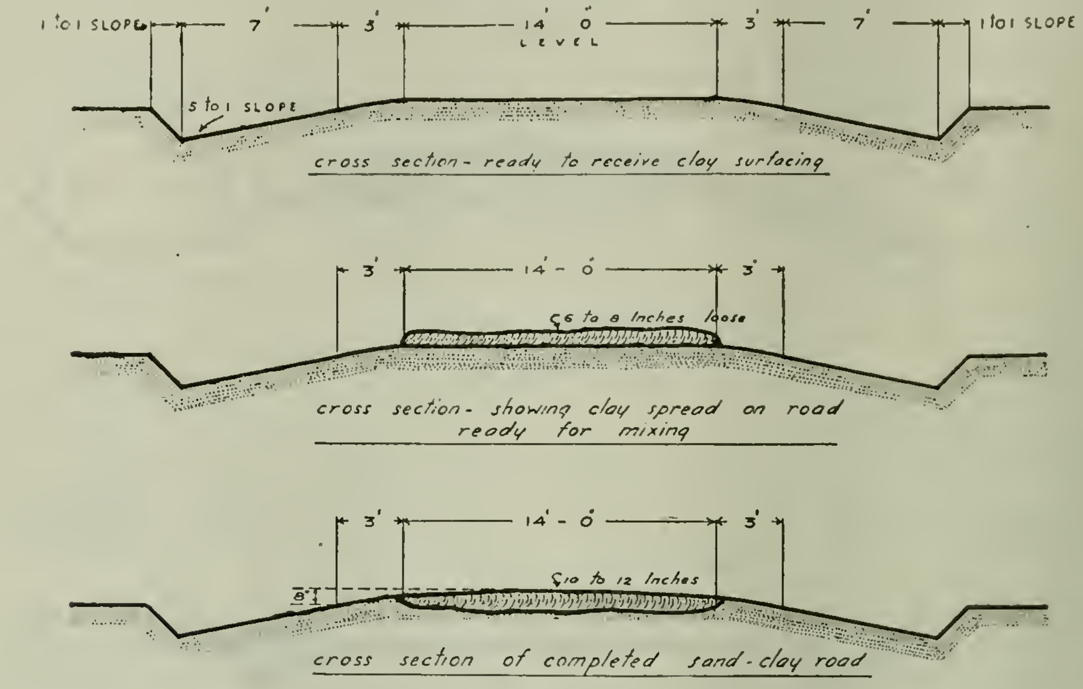
CROSS SECTION OF TURNPIKED ROADWAY

Figure 4



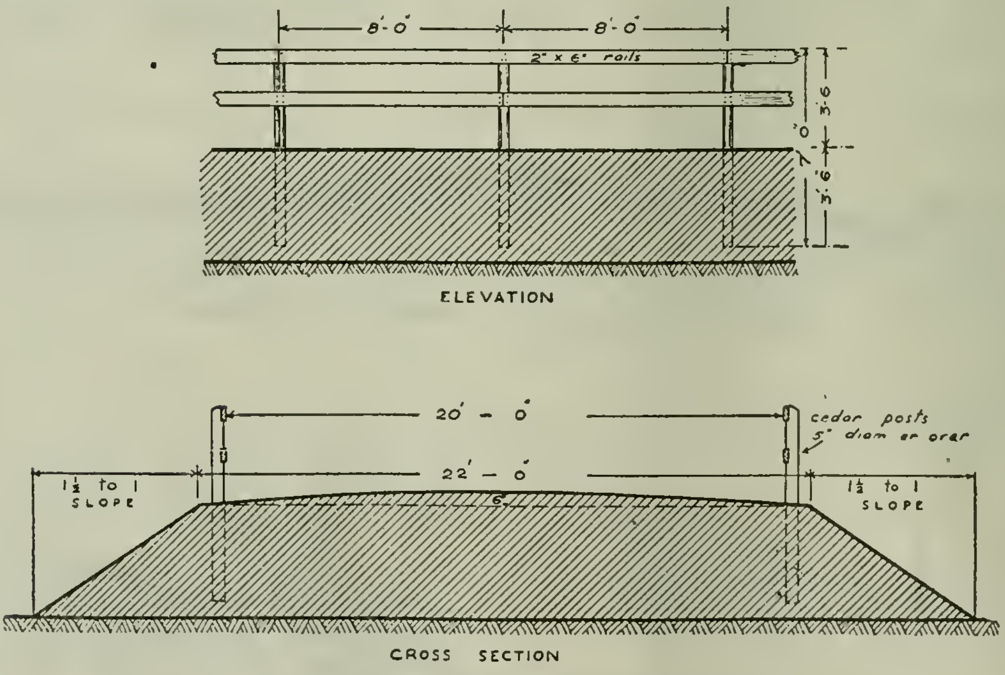
CROSS SECTION OF SIDEHILL ROADWAY

Figure 5


1 to 1 SLOPE
7'
3'
14' 0"
LEVEL
3'
7'
1 to 1 SLOPE
5 to 1 SLOPE
cross section - ready to receive clay surfacing
3'
14' - 0"
3'
6 to 8 Inches loose
cross section - showing clay spread on road ready for mixing
3'
14' - 0"
3'
8"
10 to 12 Inches
cross section of completed sand-clay road

CROSS SECTIONS SHOWING METHOD OF CONSTRUCTING SAND-CLAY ROAD

Figure 6



PLAN OF STANDARD GUARD RAIL

This progress report deals only with subjects 1, 2 and 3 of the above. That part of the report dealing with "Standard cross sections for earth roads" and "Standard specifications for the construction of earth roads" has been prepared by Mr. Carpenter, and that part dealing with "Standard culverts and bridges for earth roads" has been prepared by Mr. Lyons.

Classification of Roads

Preliminary to the carrying out of a scheme of highway improvement it is necessary to classify the roads with regard to the nature and intensity of the traffic to be borne by each road. In this report the roads are classified as:

a. provincial or trunk roads,
b. main market and interurban roads,
c. feeder roads.

Provincial or trunk roads may be described as main arteries of travel between the larger centres of population or trans-provincial roads connecting with similar roads in adjoining provinces.

Main market roads are the roads carrying the accumulation of traffic between a rural district and the market center.

Interurban roads are the roads selected as the main lines of traffic between adjoining urban municipalities.

Feeder roads include all the other roads. They serve the local neighbourhood traffic, and provide the means of reaching the more important roads included under classes a. and b.

Standard Cross Sections for Earth Roads

Standard cross sections applicable to the different conditions met with in the construction of earth roads are submitted on the diagram sheet attached.

Figure 1 shows cross section of earth embankment, figure 2 shows cross section of roadway in cut, figure 3 shows cross section of prairie grading or turnpiking, and figure 4 shows cross section of side hill roadway.

The roadway illustration in figures 1 to 4 shows a travelled surface of 20 feet. For roadways of greater or less width the only variation will be the width of the roadway and a corresponding proportionate increase or decrease in the crown.

It is recommended that the minimum width of travelled roadway for each class of road be as follows—for provincial or trunk roads 20 feet, main market and interurban roads 18 feet, feeder roads 16 feet.

The maximum longitudinal grades permissible on roads of class a. or b. is 5%, and on roads of class c. 7%.

Ditches and Slopes

All ditches should be given a uniform grade to a safe outlet. The width of the bottom of the ditches will vary with the amount of water to be carried, and the grade of the ditch. If additional earth is required to make up embankments this may be obtained by widening the ditch but never by deepening the ditch so as to interfere with the desired gradients.

Slopes of embankment, sides of road in cut, and sides of ditches should be generally made 1½ horizontal to 1 vertical.

To insure that water falling on the surface of the roadway be shed quickly to the side ditches the earth roads should be crowned so as to slope each way from the centre line at the rate of about 6-10 inch to the foot, giving a crown of 6 inches to a roadway with a ditch of 20 feet. This crown should be rounded off towards the centre of the road as shown on cross sections, figures 1, 2, 3 and 4.

Figure 5 gives cross sections showing method of construction of sand-clay surfacing and figure 6 shows elevation and cross section of standard guard rail.

Location

Highways in the prairie provinces generally coincide with the road allowances surveyed under the Dominion Lands System of Survey. The location of these surveyed road allowances was made to conform to the arbitrary system of subdividing the land into sections of uniform dimensions and these road allowances were thus staked out without any reference to their adaptability as highways of travel. In the open level prairie country no objection to this system of locating roadways can be taken, but it will be recognized that, even here, numerous small diversions from the road allowances are necessary. In the more broken parts of the west many miles of these road allowances are altogether unsuitable for permanent roads, and new locations have to be made. Short diversions are necessary to avoid obstructions to the road allowances due to deep sloughs and lakes, hills, sand deposits. to cross deep coulees by means of easy side hill grades, and to afford better locations for bridges than those obtainable on the road allowances. A great deal of useless and wasteful expenditure is made every year by inexperienced road builders attempting to construct roads over obstacles of this nature because of a mistaken idea that the road allowances must be adhered to no matter what difficulties they present. The decision as to whether or not a diversion is advisable is a matter requiring judgment and experience and the services of an engineer should always be obtained to determine this and to select and stake out the necessary new location.

Contract and Specifications

The contract and specifications for the improvement of roads is that now used by the Department of Highways for the Province of Saskatchewan in connection with the improvement of earth roads under The Canada Highways Act and is submitted as a suggested standard form of contract and specifications for earth roads construction.

*

Mr. Carpenter referred briefly to the contract and specifications for improvement of roads in the Province of Saskatchewan, which was added as a supplement to his report. He mentioned that they found it advisable in practice to reduce the crown to 6/10″ to the foot instead of 1″ to the foot, the former being more satisfactory.

M. A. Lyons, A.M.E.I.C. Good Roads Board, Manitoba, opened the discussion on the subject of the morning's session by stating that while the Committee was not unanimous, it was probably due to the fact that they had not been able to get together to settle the differences of opinion that might exist. He thought the Committee's work should have been specified first as the drafting of a Road Policy with which would be coupled standard specifications. Mr. Lyons then read his discussion.

Considerations in the Adoption of a Road Policy and Standard Specifications

Discussion by M. A. Lyons, A.M.E.I.C.

Three years ago at the Western Professional Meeting of *The Institute* at Saskatoon following papers on road construction in the three Western provinces, the apparent difference of practice in the construction of earth and gravel roads was noted by some of the engineers present, and a committee of three, one engineer from each of the three prairie provinces, was appointed to draft a "standard specification including a road policy." The writer does not think that the movers of the resolution realized just what result was to be obtained from this resolution and is sure that it has never been clear just what was desired.

Standard Road Specifications

As the writer remembers the resolution it was worded as above "to draft standard road specifications including a road policy". Examining this resolution it appears that it might have been worded to read "a road policy including standard specifications for roads". The writer does not believe that road specifications should be made too standard or even any specification so standard that it cannot be adapted to the economic situation. While there are certain fundamental principles underlying road construction it is the writer's opinion that every piece of road must be considered by itself. The depth of the drainage ditches, the amount of earth in the road, the width of the road, the crown of the road, the location of the drainage ditches, the shape of the ditches, must be varied to suit the soil, the method of doing the work and the economic needs of the community. In a rolling country of light soil, and well settled, the type of road must be essentially different from the type required in a low, level country, where the top soil is of poor road material, where the sub-soil is heavy gumbo, and where the traffic is comparatively light. The writer feels confident that a road specification suitable for the compartively arid, rolling foot-hills of Alberta would not do for some of the wet low lying contry bordering on Lake Winnipeg. A roadway 24 feet wide might be justified in a section of the country where there was a heavy traffic while it might be economically unsound to construct more than a 16 foot roadway or even less width in a sparsely settled district, the writer therefore submits that either specifications for standard roads or standard specifications for roads are not really feasible. In fact there may be sometimes an inclination to follow standard specifications too closely and the engineer does not make as full use of his own technical training, judgment and experience as he should, and that consequently designs are not as economical as they might be for the condition for which the design is made. It appears that the value of these professional meetings lies in hearing the other man's problems and how he solves them rather than in trying to have one engineer do things the same as another engineer under entirely different conditions.

Road Policy

It is suggested above that the matter of road specifications is a portion of the wider question of a road policy. This is the vital question at present for those interested in roads. The construction of roads cannot be placed on a proper basis until the sound, fundamental principles underlying a road policy have been established and adopted, and the writer knows no man who is, or should be, better equipped to assist in the discovery of these principles than the engineer, and once having these principles established the writer knows of no better man to compel them to be put into effect than the engineers, if they will only so thoroughly believe in these principles that they will endeavour to show others why these are sound principles and will unselfishly stand on these principles believing them to be for the public welfare.

In any undertaking to be successful it is absolutely essential to have a general plan to work to, and in order to prepare a plan, the object of the undertaking must be understood. Like all transportation systems there are two objects to be attained, one economic and one social. The social value of the system cannot be measured by human standards but are none the less valuable for this. The economic value of a transportation system can be studied and measured, and in order to get the greatest value for money spent on a transportation system we find that we are immediately confronted, not with a town planning system but a provincial planning system. We find that our roads are a vital part of our whole economic system. The first question therefore arises—is the development of our provinces proceeding along the most economical line? Is it more economical to induce settlers to open up new territory and construct a poor system of roads to it while the older settled portions of the province are not fully developed, or is it more economical to develop fully the older portions of the province and supply a thickly settled, well developed country with a first class transportation system and then to develop gradually to outlying districts along a provincial wide plan as this becomes justified.

We see that the principles underlying the development of a transportation system are intertwined with a province wide investigation of the suitability of lands in the older districts for further development, and the study as to whether or not it is better to develop these before opening up new lands.

Area under Cultivation in Manitoba

The writer has prepared a rough sketch showing the relative proportions of different sections of the organized portions of Manitoba which are under cultivation.

Only about one third of the organized portion of Manitoba is under cultivation, or referring to the older and more thickly settled portions, slightly over one-half is under cultivation. The first question — is the remaining portion suitable for cultivation? A careful field survey would answer this question. Is it more economical to develop the arable portions of the high priced lands and provide good transportation systems, or develop the low priced new land and supply this territory with a poor transportation system and only a fair one to the settled portions? Here is a field for investigation, but in order to show that it is not all in favour of developing the new sections the writer wishes to point out the following. Take a certain municipality in a new section of the North East of Manitoba—It has an area of 530,000 acres of which 2,300 are reported as under cultivation, and has about 1,600 resident farmers or an average of less than 1.5 acres per farmer. Think of the miles of roads which must be constructed for the produce of 1.5 acres of land. In order to serve this large number of people in such a poorly cultivated district, the roads must be far from good. Think of the cost of hauling the surplus to market over this road, if there was any surplus. This farmer would be in the same position as the man who recently sent a carload of sheep to Winnipeg to be sold. After making the sale the broker wired that the farmer must send him $1.35 additional to make up losses on the sale. The farmer wired back that he did not have the money but would send the broker another carload of sheep. The man with the 1.5 acres would owe himself money before he got halfway to town.

These views are put forward not with the idea of discouraging the drafting of a road policy but to point out the desirability of securing the co-operation of other interested bodies in ascertaining what is a desirable road policy and then how it can be put into effect.

There are these two things about a road policy; first — the drawing up of the policy and secondly getting it adopted, and it is almost useless to draw up a policy if we do not intend to secure its adoption. In drawing up the policy we must have the views of other people interested as well as the views of the engineers, and in getting it put in force it certainly must have the public opinion back of it as well as that of the several governments, and the establishing of a road policy is a part of the wider problem of provincial planning.

Is a Road Policy Desirable?

It does not appear to the writer that the adoption of a road policy by this meeting would really get us any great distance towards our goal. We either do, or do not believe that a general road policy for the prairie provinces is desirable. If we do *not* believe that it is desirable why go to the trouble of establishing a certain road policy as the policy of the Western Branches of *The Engineering Institute.* If we really *do* believe that such a policy is desirable let us take off our coats and get to work and find out what is the proper policy, for if we thoroughly believe that the policy is necessary and make no attempt to get it it seems that we are hardly sincere and that we fall short of doing our full duty. You will say that a committee was appointed to draft this policy, but there is a little more to it than writing out a nice reading road policy. After the policy is drafted it is of no use unless it is put into effect, and the money found for carrying it out. This means that governments must be favourably inclined to the policy; tax payers must see the soundness of it; agriculturalists, merchants, manufacturers and auto drivers are interested in it and must be consulted; financial men must know that the policy is sound. Until these classes of men are satisfied, the mere drafting of a road policy and its adoption by this meeting would not actually achieve what we say we desire, although its adoption by this meeting might mark it as very worthy of careful consideration.

Personally the writer thinks that a sound comprehensive road policy is absolutely essential to ensure the wise spending of the large sums of money which will go into road construction in Western Canada. Some one must, and will, take the lead in ascertaining what this policy should be and why should not this *Institute* take the initiative? It has been suggested that one way of doing this would be an offer of assistance to the governments by *The Institute,* towards studying and drawing up a road policy. Personally the writer had in mind the feasibility of going a little further and have *The Institute,* or a committee appointed by *The Institute* endeavour to call a meeting of representatives from the three governments, from the unions of municipalities, from agricultural societies, and from the motor leagues to make a study of a road policy. Now all this means a lot of hard, ceaseless and discouraging work and after a proper policy is arrived at, a lot of further work of education, publicity and persuasion before the policy can be put into effect. The policy will cover the expenditures of millions of dollars which must come out of the pockets of the tax payers; and before the tax payer can be separated from his dollar he will have to be shown where he is going to get one dollar and eight cents back in some form or other. But if this meeting is absolutely sincere in its belief that the adoption of a road policy in the three Western provinces is desirable now is the time to start unbuttoning our coats for some hard work.

Having been in touch with road construction for the past eight years the writer might point out to those whose thoughts have been along different lines of work, some of the points to be considered in a road policy.

Road Classification

Probably first comes the general policy of how the work is to be handled, whether by the provincial government, the municipal governments or both. If by the provincial government is it to be by a commission or by a minister of highways, or as a sub-department of another department? Here is where you will strike snag No. 1, or perhaps it had better be called a sunken rock.

Next, undoubtedly, is the classification of roads. This is essential in order to ascertain the class of construction, the cost of construction and a fair division of costs. There are the two purposes of roads — first to bring the wealth of the farm to the main arteries of the transportation system, the railways, second—as passenger routes or through roads or provincial highways These last are sometimes of little value locally and in order to serve through traffic in many cases must be of a much higher type of road than will be warranted by the local traffic; and on the other hand many roads which serve as highways will be of greater benefit locally as market roads than as through roads. Market roads will be divided into two or perhaps three classes. Then there are the town to town roads which mostly serve some local purposes. As a rule however these are also main market roads. It therefore appears that there might be four classes of roads in Western Canada. Now the problem is to classify these roads; and to say who is to do the classifying. Shall the roads be classified and their classification fixed by legislation so that there cannot be further dispute or shall the system remain flexible with its endless disputes entailed? Shall the classification be done arbitrarily by a body appointed to go carefully into the matter, or shall it be done by the local authorities and their decisions followed, or shall it be done by a dozen other methods which might be suggested? There are whole bunches of worry and chances for disagreements wrapped up in these questions. After the roads are classified how is the cost to be apportioned? Who by, and on what basis? Who should pay for provincial highways? Should the motorist pay the greater proportion? Undoubtedly any construction of a good Western wide system of highways is worth more to the motorist who uses them than any license which he has to pay now. Some provincial highways are of very little local value, others are of more value locally than they are to the motorist. Who is going to pay for the market roads? Are they of such indirect general value to the province as a whole that the city tax payer should pay his share or is the farmer the man who will get the greater part of the value for every dollar spent. Who is going to say how these costs will be apportioned? How about financing? Who will do it, and how shall it be done? Shall the provincial government do it all and collect from the municipalities? Instances can be given which would lead you to consider this method. Shall the municipaities do their share and the government its share? There are good reasons for doing it this way. Shall any department of the government have any control over the municipality in the spending of its share? Should the Dominion government bear a share of the cost, and if so which roads and under what conditions and to what extend? How shall the work be paid for? Entirely out of capital expenditure, partly out of capital expenditure, out of current funds, entirely by debentures or partly by debentures and for what term of years should the debentures be issued?

Construction

Then about construction, who will have charge of this, the municipality, the government or dual responsibility? Should the government do any construction or establish industries to assist in constructing roads. These are some of the points which must be settled before an acceptable policy can be drafted and ones which, in my opinion cannot be settled by engineers alone.

The writer therefore submits as his own opinion that when we were asked to draw up a "standard road specification" we were asked for something which is not desirable, and when you added "including a road policy" three men were handed something which they as engineers alone cannot satisfactorily handle. The writer does believe however that this *Institute* can be the nucleus of an effort to discover and establish a proper road policy for Western Canada if we will but put the same force into our efforts that we are accustomed to put in tasks which we allow others to set for us, but we must seek the co-operation of other bodies of men in order to make a success of a road policy.

Consider another certain municipality in a well settled district with an area of 275,000 acres of which 166,000 acres are under cultivation, and which has 483 resident farmers. The average number of acres under cultivation per farmer is about 340. Here is a place where the construction of good roads would pay. Would it not be better to have the 1600 farmers who now have 1.5 acres under cultivation settled in a country where 60 per cent is under cultivation and construct for this fully developed municipality a first class system of transportation.

These examples show that the first step in our road policy is provincial planning.

Discussion

At the conclusion of Mr. Lyons' report, the chairman expressed his opinion that it was well within the province of the engineering profession to draw up a road policy which, of course, might be changed as conditions warranted. The meeting was then thrown open for general discussion.

At the onset the discussion on the subject of highways became sidetracked from a remark made by Mr. Lyons in connection with the composition of culverts, and was participated in along this line by Messrs. Walkem, Dutcher, Walley and others. It was pointed out by the chairman that the subject of the deterioration of iron and steel due to alkaline action would be covered in the afternoon session.

Wm. T. Thompson, M.E.I.C., of Preeceville, stated that in his opinion there should be a standard specification which, although it might not be followed on every occasion, would serve as a guide in a general way. Thomas T. Wilson, A.M.E.I.C., district engineer, Good Roads Board, Manitoba, thought that the question of policy was beyond the province of the engineer, and that his work should be confined almost entirely to construction. Professor E. G. Matheson, M.E.I.C., was strongly of the opinion that the engineers were essentially the men not only to do the construction but to devise a proper policy and also to see that the proper men were in control so that money should not be expended unnecessarily. He cited instances of men occupying positions such as minister of public works who were not qualified. Although engineers might not agree regarding a standard specification, the adoption of such would be a help to every engineer. Mr. Carpenter was emphatic in his belief that while it would be easier for the engineer and possibly more to his liking to attend strictly to the construction of highways, leaving the question of location and financing to others, such a policy would mean losing one of the greatest opportunities engineers had of occupying a high position and of assuming responsibility for which they are eminently qualified. (Applause). He mentioned that the cross section submitted with the report was presented more as representing a type than a standard. The chairman heartily agreed with Mr. Carpenter's sentiments, believing that engineers are altogether too reticent and thus liable to lose opportunities of accentuating the importance of their profession. The question of the life of debentures for various public undertakings is one on which the engineer is well qualified to advise; the practice in the past had not been based on sound engineering economics. R. M. Moffat, A.M.E.I.C., stated that his firm belief was that the engineer was essentially a man to formulate a road policy and look after the business side of it. He expressed a note of warning to the profession that there would be many difficulties and obstacles placed in the way of a general road policy, particularly by small municipalities. He was in favour of the committee continuing in a little more energetic fashion, and bringing in a report which might either be accepted or rejected at the next meeting.

A motion to enlarge the personnel of the committee evolved considerable discussion. It was finally resolved moved by Mr. Muckleston, seconded by Professor Matheson:

> **"That the present committee be continued and enlarged to include three from each province, the additional members to be appointed by the executives of the various Branches, and that this committee as a Committee of the Institute assume the responsibility of bringing in a report at the next professional meeting."**

Motion carried unanimously.

At the conclusion of the morning session it was decided in the absence of President Fairbairn that the Chairmen present from the various Branches should preside at the different sessions. At the adjournment the members and ladies assembled in the refectory of University Hall where all meals were partaken of in assembled groups, adding much to the social enjoyment of the gathering.

Concrete in Alkali Soils

Afternoon Session, Wednesday, August 10th, 1921,

Under the Direction of the Saskatchewan Branch.

The chair was occupied by H. S. Carpenter, A.M.E.I.C., formerly Chairman of the Saskatchewan Branch, a Councillor of *The Institute.* Universal regret was felt owing to the absence of President Fairbairn, and on motion by Wm. Pearce, M.E.I.C., seconded by C. W. Dill, M.E.I.C. It was unanimously resolved that—

> **"We the Western members of the Engineering Institute assembled at the Western Professional Meeting at Saskatoon, regret exceedingly that Mr. Fairbairn is unavoidably absent due to ill health, and in extending sincere wishes for a speedy recovery are looking forward to an opportunity of meeting him at the various Branches at an early date."**

A copy of this resolution was wired to President Fairbairn. An announcement was made that at 4.30 cars would be ready to take those who desired to play golf to the golf club.

Professor G. M. Williams, A.M.E.I.C., a member of the Institute Committee on Concrete Deterioration in Alkali Soils, and at present engaged on the field work for this committee, read his paper on the above subject which included a summary of the result of laboratory studies together with details of the Bureau of Standards field investigation, published in the August Journal, page four forty-six. In addition to the illustrations published, Professor Williams illustrated his address by a number of very interesting lantern slides showing the results of the field work in various parts of the United States.

Discussion

In opening the discussion on this subject A. S. Dawson, M.E.I.C., chief engineer, Department of Natural Resources Canadian Pacific Railway stated that he considered this the most important matter up for discussion at these meetings, not only from the standpoint of the construction engineer and research chemist but as affecting all governments, corporations and individuals whose money is being used on the construction of works in districts where certain conditions obtain.

This memorandum is supplementary to paper presented by Mr. Dawson, on behalf of the Committee of the Calgary Branch of *The Institute* at the Western Professional Meeting at Saskatoon in August 1918, and at a similar meeting at Banff in August 1920. It may be assumed that as a result of the papers presented at the former Saskatoon meeting the Institute Committee consisting of men from the three prairie provinces was created, and the work organized along broad lines requiring the full time of a research chemist for a period of at least three years.

Report of Calgary Committee on Deterioration of Concrete in Alkali Soils

Presented by A. S. Dawson, M.E.I.C.

Briefly stated, the work of the Calgary Committee to date has been as follows:—

Calgary Experiments

In October 1918, 270 concrete blocks and 180 cylinders were made at Calgary, under close supervision.

These blocks were moulded in wooden gang moulds, 10"x10"x30" long, and the cylinders in steel moulds, 8" in diameter and 16" long. Two hundred and sixteen blocks were made, using Western cement, and fifty-four from Owen Sound cement. All were carefully marked for identification purposes.

All materials used were analysed physically and chemically.

The gravel was from what is known locally as the Carseland Pit, a well graded, bank-run material. The water was from a City of Calgary Main. Samples of soil and ground water were procured from each hole, in which a specimen was placed.

The blocks were made in three series.

(a) Screened, sized, and washed. The sand was supposed to grade uniformly from fine to coarse — not to exceed 40% by weight, passing a No. 30 screen, and not more than 30% by weight, passing a No. 100 screen; and the voids were not to exceed 35%.

The gravel was supposed to be uniformly graded in sizes from ¼" to 2" in diameter, and the voids not to exceed 40%.

(b) Bank-run material, washed.

(c) Bank-run material, unwashed.

Each series of blocks were made in two mixes.

First, 1 — 2 — 4.

Second, 1 — 1½ — 3.

Of each mix, three blocks were plain.

Three were treated with two coats of soap and alum.

¾-lbs. of castile soap, per gallon of water, heated to 180 degrees F.

2-oz. of alum to 1 gallon of water, heated to 100 degrees F.

1 coat of hot alum solution.

1 coat of hot soap solution.

1 coat of hot alum solution, after 24 hours, all well brushed in.

Three were treated with water gas tar and coal gas tar, as follows:

First coat, refined water gas tar of thin consistency.

Second coat, same, and immediately after the first.

Third coat, refined coal gas tar, applied hot, after coats one and two were well soaked in.

Fourth coat, same as third, after third coat set.

The blocks were taken from the moulds in 48 hours and cured for 28 days, after which they were placed in the ground 22 inches, with 8 inches exposed, at the following points:—

(1) On top of a high hill in Calgary, where no alkali conditions were likely to exist, and where there would be no ground water in contact with them.

(2) Near a sewer, in a low-lying plot of ground, in Burns-land, in Calgary, generally wet, and where alkali conditions had given evidence of being bad.

(3) At Strathmore, in a low-lying plot, once a slough—where alkali conditions seemed bad, and where they would probably be wet most of the time.

(4) Near Brooks, in a low-lying place, where the alkali conditions were apparently very bad, and where they would be wet most of the time from seepage water from an irrigation ditch.

The cylinders, which were all made of Western cement, were buried in the foregoing points, and 62 were placed in the Calgary city hall laboratory.

Conclusions to date

1st. Laboratory test cylinders are all relatively lower in strength than field tests because of the difficulty of maintaining a uniform degree of moisture.

2nd. The blocks and cylinders located in the Calgary district showed no disintegration, chiefly because of the fact that the ground conditions were relatively much dryer than normal.

3rd. The blocks at Cassils showed a much greater disintegration than those at other locations because of the greater concentration of soil solutions. Those at Strathmore show the next greatest degree of disintegration, because of the less concentration of soil solutions, and possible drying out at certain seasons.

4th. In a concrete of high density, where absorption of the alkali ground water appears to be mainly at the surface of the concrete, the action appears to be relatively slow, and is largely in the nature of surface action, gradually extending to the interior.

In a concrete of low density and relatively high porosity the action is more rapid, as it appears to take place simultaneously throughout the structure.

The more porous concrete is subject to the action of other disintegrating forces of a physical nature, such as frost action and the crystallization of salts in the pore space.

A dense concrete mixture, through some property not determined, such as a low percentage of pore space, or the character of this pore space, results in a greater resistance to the action of the alkali ground waters. Apparently this is true in either mixture 1 — 1½ — 3 or 1 — 2 — 4. Chemical action takes place over relatively small distances; direct contact of the re-acting elements being necessary. The more porous concrete allows this more intimate contact throughout the structure, and consequently more rapid action takes place.

5th. As far as our experience goes in this connection, the presence of alkali soil solutions does not retard the setting of the cement.

6th. The action is undoubtedly more rapid in weaker mixtures and mixtures of low density.

7th. No apparent difference in field results was found in blocks and cylinders made of Eastern and Western cements.

8th. Blocks after approximately 20 months curing in the Calgary district, on which no alkali action has yet become apparent, were transferred to the Cassils location, and disintegration started to show up on many of them during 10 months' exposure.

9th. Tar coating in most cases has proven somewhat effective in protecting the surface of the test specimens thus treated. Some blocks so treated are absolutely sound at the end of 2½ years, although many of them are disintegrating rapidly at ground level, and for varying distances above and below the surface. In other words, the tar treatments seem to have delayed, but do not entirely prevent, alkali action. This character of treatment should be further studied.

10th. Soap and alum treatment seems to have little value at or below ground level.

11th. 1 — 1½ — 3 mixtures would appear to stand up better than the 1 — 2 — 4 mixtures against alkali; and the richer mixture with tar treatment has given best results.

12th. The general conclusion to be drawn from the results of compressive strength tests at the end of 20 months, is that with these materials, washing, screening, and grading of material produces concrete of higher strength, and the expense of such is justified by the results obtained.

On the whole the Y (1 — 1½ — 3) mix showed up better than the X (1 — 2 — 4) mix, and it would appear that the concretes with the highest tensile and compressive strength stand up best under alkali conditions.

13th. No doubt frost action played a part in the disintegrating process. The worst conditions, particularly in the influence of disintegration, were most apparent on the South and West sides—where the rays of the sun and the prevailing winds would naturally have most influence.

14th. It is probable that the cements with the highest tensile and compressive strength add materially to the life of concrete placed in alkali soils.

In regard to the tensile tests. The results of laboratory tests clearly indicate that the Eastern cement gave better results on the short term tests than the Western cement, although the results seemed to even up pretty well at the end of twelve months.

15th. So many comments are noticed in semi-technical, and even technical journals regarding the action of alkali on cement, that it is apparent that a misapprehension exists in the minds of many. The destruction of concrete in alkali districts has not as yet been proven to take place in strongly alkaline solutions. Experience appears, however, to point to the most severe action in the presence of sulphates and chlorides of sodium and magnesium soil solutions of not more than mildly alkaline re-action.

Special Concretes

A large number of cylinders and blocks have been made during 1921, of ordinary cement, Super-cement, and Gunite, and also of Toximent, Waterex, Impervite, Anti-Aqua, and other rather wellknown waterproofing compounds; but these have not yet been in the ground long enough to warrant any conclusions being arrived at.

Specimens of glazed and unglazed tile, galvanized corrugated iron pipe, cast iron pipe, steel pipe—plain and burlapped and tarred, lead pipe, galvanized iron pipe—plain and tarred, and wood staved pipe have also been placed alongside the concrete blocks for close examination in the future.

The important practical phase of this matter is to make the best possible progress in the experimental and research work already started by the *Institute* committee; and in the meantime to take all possible precautions and adopt all remedial measures which give any promise of success on new work, and which may also help to prevent further deterioration in existing structures

Suggestions

In this connection the following suggestions may be of value:—

1. Efforts should be made to get the densest possible mixture, and in this connection the smallest quantity of water consistent with good work should be used; in other words; a quaking mixture should be made of a workable mix, i. e., to a consistency that will permit of the concrete flowing around the reinforcement with thorough puddling, and not so as to cause the finer particles to be carried to the top in suspension, and the heavier ones to settle. About one gallon of water to each cubic foot of concrete in place is a fair average for a good mix.

2. The best possible materials procurable should be used—and the best graded mixtures. All bank-run material or river gravel should be screened out and remixed in proper proportions—based on proper tests made as to voids.

3. It is desirable that all material should be washed and it is almost essential that the sand should be washed. Since concrete of the greatest possible strength has been proven to be more resistant to alkali action, the object of careful selection and washing of the aggregates is to obtain the highest possible strength with a given mix. This washing will remove excess of silt and organic matter commonly present, as well as alkali salts that are known to affect the strength of concrete materially. It is practical to use local materials with a considerable saving by adopting the above ideas.

In this connection, however, it would be folly to assume that sands can be properly selected, and passed on, without proper tests having been made on them.

4. More care should be exercised in making field joints, using ½″ of 1 to 2 grout on the junctions between the old and new work.

5. Where chutes are used, they should be on easy slopes and kept down to the shortest possible length.

6. The time of mixing is an important factor, and it is now generally conceded that the best results are

obtained from machine mixing for a period of about 1½ to 2 minutes continuous revolving of the mixing drum.

7. Backfilling with sand and gravel with the coarser material next to walls, and plenty of weep holes are all extremely desirable, and particularly on such types of structures as have been mentioned in previous reports, and are more easily subject to alkali conditions.

8. Proper seasoning and protection from the elements, and not too early removal of forms. It is important to remember that the methods and operations adopted in mixing concrete, are just as important factors affecting its density, strength, and permanence, as are the qualities of the materials used.

9. Closer supervision of all work done, by men who really know the concrete business, is essential.

As brought out in the writer's former memoranda on this subject, it is not the purpose of this committee to attempt to discourage in any way the rapidly growing use of cement in its manifold forms of application; but rather with the belief that "forewarned is forearmed" by calling attention to the dangers which do exist, and the necessity of taking all possible steps to avert trouble and financial loss.

The whole question serves as an illustration of the inter-relation of chemistry and engineering which exists in connection with the construction of large works and of the necessity for the closest co-operation on the part of all concerned.

Report of Manitoba Committee on Deterioration of Concrete in Alkali Soils

Presented by Prof. J. N. Finlayson, M.E.I.C.

It is the purpose of this paper to place on record some results obtained by investigators on the effects of alkalies on concrete structures in the vicinity of Winnipeg, and also the results of laboratory tests conducted by engineers and chemists relative to this important topic.

It was found impossible to have all the Manitoba investigators present at this meeting to speak for themselves and to tell their own stories. In their absence, the writer has attempted to collect the information and will present it to you as concisely as possible.

As early as 1909, the officials of the sewer department of the City of Winnipeg experienced trouble with their concrete sewers. In that year, it was discovered that a 12 inch concrete pipe sewer on Pacific Ave. constructed in 1882 had disintegrated causing subsidences to such an extent that the sewer was subsequently removed and replaced with tile pipe. Since that date there has been a continuous series of failures of concrete sewers necesitating expensive repairs and replacements. The worst cases of disintegration of concrete sewers appear to occur at the connections of sewer pipes to larger sewers. Presumably the pipe line serves as a natural drain for the ground waters carrying highly concentrated alkaline solutions which are deposited in the regions adjacent to the trunk sewers. The extent of the damage done to the Winnipeg sewers by alkalies was recorded by B. S. McKenzie, M.E.I.C., in his paper read at the Banff Meeting in 1920.

The most valuable series of observations and tests made in Manitoba to date are those of the Greater Winnipeg Water District. During 1917 and 1918, H. M. Thompson of the Water District engineering staff paid considerable attention to the subject, proving among other things, that concrete premoulded and steam cured before placing in the ground will decay when exposed to concentrated solutions of sulphates; also that integral treatments with soft soap and alum are ineffective in preventing deterioration of briquettes exposed to similar solutions.

In 1919, W. G. Chace, M.E.I.C., chief engineer of the Greater Winnipeg Water District, recommended a system of underdrainage for the protection of the 96 inch concrete pipe on the water line just East of Deacon. The need of underdrainage arose from the fact that the alkalies in the ground water were disintegrating the surface of the pipe notwithstanding the fact that extraordinary precautions had been taken to secure a dense and rich body of concrete.

The work of underdrainage is now proceeding and periodic inspections of various portions of the pipe and of the soil and ground waters adjacent to the pipe are being conducted, Mr. Blackie, city chemist, Winnipeg, being associated with the engineers of the G. W. W. D., in making the tests.

Samples of ground water were taken from holes made at the side of the aqueduct where it had been exposed for examination, and the analyses show that the worst cases of deterioration occur in close proximity to the spots from which waters high in sulphate content were found. For example, near station 820 + 00 where the water showed a sulphate content of 7440 parts per million (i. e. ¾ of 1% of water body), the arch was found to be badly affected, with blisters 6″ diameter, and nearly 1″ deep; invert softened; while at the next point of observation 100 ft. distant where the sulphate content was only 600 parts per million, the arch was found to be in good condition, the invert only showing a trace of alkali action; but some concrete which had been spilled near that station was badly softened.

In addition to the above examinations, a series of test holes, protected from surface drainage by pipes, have been put down and samples of water from these holes are being collected every month in order to find out what variation in the concentration of the ground waters takes place during the year. The results of these observations will be announced in due season.

In the city laboratories, Mr. Blackie has been investigating the action of 10% solutions of magnesium and sodium sulphates on sand briquettes of varying mixes and on briquettes of neat cement. The results of these tests show that all aggregates are attacked, the most rapid decomposition occurring in a mix of one part cement and three parts standard Ottawa sand, and that even neat cement will eventually become soft and friablet Perhaps Mr. Blackie's most interesting experiments have been with a natural cement manufactured near Winnipeg and known on the market as "Commercial Cement". This cement has a low calcium-silica ratio as will be seen in the following table.

	Commercial Cement	Portland Cement
Silica	22.48%	22.18%
Iron and Alumina	14.46%	9.40%
Sulphuric Anhydride	5.34%	3.80%
Calcium	47.86%	60.06%
Magnesium	0.00%	2.78%
Loss on Ignition	9.30%	1.74%
	99.44%	99.96%

It was found that briquettes made of 1 part of commercial cement and 3 parts of standard Ottawa sand exposed to 10% magnesium sulphate solution showed no signs of disintegration at the end of twenty months, whereas briquettes made of the same proportions but using Portland cement instead of commercial and exposed to the same solution showed signs of disintegration at the end of three months and at the end of six months, the disintegration was complete. Further experiments show that the addition of comparatively small quantities of free lime to the commercial cement causes disintegration in the briquettes similar to that observed when Portland cement is used. Mr. Blackie calls attention to the magnesium content of the two cements in the light of Messrs. Wig and Ferguson's statement that the presence of magnesium in cement has no effect on its stability in sea water. The regrettable feature of commercial cement which precludes its use for engineering structures other than lightly loaded sidewalks, is its irregularity of composition and its low compressive strength. Its tensile strength is also initially low but comes up well in time, but tests made in the testing laboratories of the University of Manitoba show no increase in compressive strength even after a period of ninety days. Some experiments were made by Mr. Blackie to ascertain the effect of what might be called the stabilizing of the lime content in Portland cement. Soda was added to the cement in varying proportions in the hope that an alkali resisting cement might be obtained. For a time it looked as if Portland cement so treated would possess alkali resisting properties similar to those of commercial cement, but later it was found that disintegration was proceeding under the outer coating of the briquettes. It is thought, however, that here may be a fruitful field for further investigation and that perhaps a mixture of Portland cement and commercial cement may be obtained which will produce a concrete, alkali resistant, and of adequate strength in both tension and compression.

The same investigator has shown that ordinary lime sand brick will resist the action of alkalies, and he is of the opinion that this resistance is due to the calcium carbonate binding material used in the manufacture of the bricks. There is also a field here for further investigation.

It is a matter of regret that we have been unable to obtain supplies of Super Cement during the past year, but it is gratifying to note that tests will now be made to determine the alkali resistant properties of this new product.

During the past year, experiments has been carried on at the laboratories of the University of Manitoba and some results corroborative of those obtained by Mr. Blackie have been secured.

A most interesting series of tests have been made by Dr. J. W. Shipley, assistant professor of chemistry, University of Manitoba, working under the direction of W. NelsonSmith,M.E.I.C.,consulting engineer for theWinnipeg Street Railway in order to determine the effects of alkalies on cast iron pipes, and considerable evidence has been secured which tends to show that the presence of sulphates and chlorides in the soil of Winnipeg and adjacent municipalities may be a contributing factor in the corrosion of water pipe generally attributed solely to electrolysis. It is suggested that the Committee on Concrete Deterioration may be permitted to enlarge its province to include an investigation of the effects of alkalies on cast iron, wrought iron and lead pipes. As a result of such investigation, we may be able to throw some light on a question which has provoked considerable controversy during recent years.

Discussion

City Chemist Blackie of Winnipeg was present and supplemented the report of Professor Finlayson by giving the results of tests made with ten per cent solutions of magnesium and sodium sulphates on sand briquettes of varying mixes and of briquettes of neat cement. He pointed out that in experimenting with natural cement and Portland cement the Portland cement aggregate suffered severe deterioration while apparently the natural cement was not attacked after a period of two years.

In view of the important facts proven by investigation of W. Nelson Smith, M.E.I.C., regarding the action of alkaline salts on metals. an important contribution under the heading of "Self Electrolysis of Metals", was given by Mr. Smith which owing to the lack of space it is impossible to publish in full in this issue but which will appear in the next number.

As an illustration of the corrosion of cast iron pipe by self electrolysis Mr. Smith showed a sample taken from a pitting of a cast iron pipe which bore the appearance of a transmutation of the metal into a graphitic substance Discussing this phenomenom Major Walkem remarked that the same was in evidence in the cast iron condensers in marine practice, it being necessary to protect them by means of a coating of neat cement and fresh water. Mr. Smith pointed out that this action was identical and due to the same cause—the presence of magnesium or sodium sulphate in salt water. Dr.Wallace mentioned that in his study of granite boulders lying in flat lands containing alkaline solution he noticed considerable weathering of the granite, that where the granite was alternately wet and dry there was a considerable weathering due to the silicates in the granite being affected apparently by the sodium chloride and the potassium sulphate. He was of the opinion that since the disintegration of granite covered a longer time period and no weathering occurred where air was excluded, the situation might be similar in relation to the action of salts on concrete. The chairman mentioned an instance of an hotel foundation in Montana where the water table had been raised by irrigation and the concrete foundation sandstone capping and the brick above moistened by capillary action had all suffered a certain amount of disintegration, showing that this action is not confined to concrete, but that sandstone and brick also were affected. Following a suggestion by one of the members that possibly some coating material might be used to effectively protect the concrete, B. S. McKenzie, M.E.I.C., of Winnipeg, cited a case where through a protection of several layers of tarred canvas severe deterioration of the concrete had been noticed. M. T. Cantell, A.M.E.I.C., suggested that a more careful selection of the aggregates used would improve the situation. He mentioned a case of the first marine concrete work in England where a breakwater deteriorated and examination showed that the limestone aggregate was particularly affected, and that the use of granite and gravel had remedied the situation. He requested information as to what observations were available showing the results of sewer gases on concrete, the subsequent discussion bringing out the fact that no apparent deterioration resulted from that cause. W.P. Brereton, M.E.I.C., mentioned reading an article on the use of Roman cement in harbour works which showed that there was no adverse action from sea water in the particular described. Mr. Dawson exhibited samples of steel taken from reinforced concrete at a point fifteen miles distant from an electric plant light and thirty miles from a street railway station which showed evidence of considerable corrosion. Mr. Smith showed a map of the Winnipeg District pointing out the location of pipe badly deteriorated located at a distance of three miles from the nearest electric railway line.

(Owing to the location of the official stenographer in the hall, and the failure of many of the speakers to address their remarks in the proper direction, a large amount of the discussion at this meeting was unfortunately not secured.)

The Audion and its Applications

S. R. Parker, A.M.E.I.C., Department of Telephones, Province of Saskatchewan, read his paper on this subject as published on page four fifty-six of the August Journal, prepared jointly by himself and S. B. Sherman, A.M.E.I.C of the same Department,which described the development of the thermionic valve and its application to telephony. A demonstration was given of the magnavox by the reproduction of phonographic records from a music store in Regina, including classical instrumental and popular vocal selections.

In the evening a motion picture film was shown illustrating the manufacture of ingot steel.

Water Supply and Irrigation in Saskatchewan

Morning Session, Thursday, August 11th, 1921,

Under the Direction of the Alberta Branches.

The chair was occupied by B. L. Thorne, M.E.I.C., Coal Mines Branch, Department of Natural Resources Canadian Pacific Railway, Chairman of the Calgary Branch.

A paper covering this subject was read by G. N. Houston, M.E.I.C., secretary of the Irrigation Council, Province of Alberta, in which the author gave an exhaustive description of the water supply and irrigation schemes of Alberta, illustrated by a map showing the location of the various streams and the different irrigation schemes either under way or projected. Mr. Houston's paper was handed to the author for revision, and will appear in a future issue of the Journal.

Discussion

Lieutenant Colonel A. J. McPherson, A.M.E.I.C., chairman Water Supply Commission, Province of Saskatchewan, in opening the discussion on the subject, expressed his appreciation of the information given by Mr. Houston concerning water supply and irrigation schemes as affecting the three prairie provinces. He referred to the project now under discussion to take water from the South Saskatchewan River near Riverhurst to ensure a permanent water supply particularly for the cities of Moose Jaw and Regina, and also for the Southern part of the province, which he had occasion to investigate thoroughly in his capacity as chairman of the Water Supply Commission. They had come to the conclusion that if all of the proposals to take waters from the Saskatchewan River in Alberta materialized, they would not seriously affect the supply needed for Southern Alberta. They were more interested in the minimum flow, which occurred in January and February, which flow would be increased rather than diminished by the irrigation projects. Their proposal involved taking a maximum of twenty-three cubic feet of water per second out of a total minimum flow of twelve hundred and forty-seven cubic feet per second, which showed that the enterprise would not affect the down stream localities in any way. He discussed the practicability of using the river for a hydro-electric project, utilizing the maximum power which was available in the summer time for irrigation, which by using the power for pumping water from the river would eliminate the use of long ditches. With a minimum of four thousand horse power available at low water, and from forty thousand to forty-five thousand at high water, he considered the proposal at least worth investigating. The first claim on the water from these streams is for domestic purposes, irrigation coming second, and power purposes last of all. An investigation in Saskatchewan led to the conclusion that there would be very little demand for water for irrigation purposes in this province. Owing to the fact that there is a definite limit to the supply of water both in Alberta and Saskatchewan, it is apparent that it will be necessary to conserve the water in the future. In Colonel McPherson's opinion, outside of two small proposals, irrigation was not a live issue in Saskatchewan. The success of the irrigation projects in Alberta would influence irrigation projects in Saskatchewan, concerning which, particularly regarding the use of water, considerable education is necessary.

Sam. G. Porter, M.E.I.C., in opening the discussion stated: "Mr. Houston referred to a treaty between the United States and Canada for the division of water on international streams. That treaty went into effect in 1909, and provided that the water supply of the Milk River and the St. Mary River and their tributaries, for the purpose of division between the two countries, should be treated as one, and divided equally between the two countries. On the face of it that seems simple, but when you take into consideration the fact that these tributaries cover an area of several hundred miles in extent, and that the division would have to take place at a number of different points, it becomes a very complicated problem to make that division.

An international commission was provided for in that treaty, whose duty it would be to study this problem and to administer this division. Up to the present time no final decision has been rendered as to the method of that division. There is a big area in Southern Alberta, as described by Mr. Houston, known as the Lethbridge South Eastern project, whose development is dependent upon the settlement terms of that treaty. Whenever a question comes up of development of this area, the first answer is "We cannot do anything until we know just what water supply we have under the terms of this treaty" and that will continue to be the answer until these questions are answered. Now in view of the fact that the development of this large area is dependent upon the settlement of the terms of that treaty, and in view of the further fact that all the engineering data are already compiled and available, and hearings have been held before the commission, so that all that seems necessary is for the commission to come to a conclusion, and for that conclusion to be endorsed by the two governments I wish to present a resolution here:—

"Resolved that the Engineering Institute of Canada, assembled in convention at Saskatoon, shall urge upon the Premier of Canada and the Minister of Interior to take every means in their power to effect an early settlement of the terms of the International Waterways Treaty, in order that this development may go forward."

Major H. B. Muckleston, M.E.I.C., seconded the resolution, stating that it was very difficult for people not living in the area affected to understand what a vital question this is to those farmers. Farmers in that area have been without crops for five years, and their one hope lies in securing water from the scheme projected, there being no reason why the delay should continue. The one vital problem in the lives of the farmers in this district is the interpretation of the International Waterways Treaty. If they do not get the water they must get out. As one farmer said down there: "There are only two avenues for us; it is either irrigate or emigrate." The resolution carried unanimously.

William Pearce, M.E.I.C., who has fathered the North Saskatchewan irrigation project, being the greatest yet devised in this country, spoke briefly about this project. He mentioned that instead of allowing water to run off at high water it was proposed to establish great storage basins which would eliminate much of the present loss. Speaking of the need of water on the farms in Saskatchewan, he stated that farmers could take a chance with grain growing, but to consider raising stock they must have water. He thought the Government should take early action to determine where the storage site should be, and to arrive at an estimate of the cost of the project. Following Mr. Pearce's remarks, it was moved by Mr. Carpenter, seconded by Mr. Craig of Calgary:

"That this convention of the Engineering Institute of Canada should urge upon the Minister of the Interior and the Prime Minister of the Dominion that all steps should be taken to carry on the necessary preliminary investigation in connection with the North Saskatchewan Irrigation project, in order that the information should be available at an early date as to the feasibility and advisability of the scheme."

Major Muckleston pointed out in connection with the co-operative irrigation schemes that there were phases of their propositions which were likely to lead to disaster, if not rectified. One was a lack of proper education by the farmers themselves regarding using the water, and the other was the fact that the land holdings of the men interested in these things were altogether too large. He believed that a quarter section was as much as any one man could properly look after where irrigation was used.

Mr. Dawson, of Calgary pointed out that on two-thirds of the earth's surface agricultural operation have to be carried on, to be successful, under a combination of irrigation and dry farming or irrigation alone, irrigation being essential in one-half of that area. The meteorological records for the last twenty-five years of the the province of Saskatchewan go to show that irrigation for agricultural development is essential in a large portion of it. An invitation from the government of Saskatchewan to the Western Canada Irrigation Association to hold its annual convention at Maple Creek next year shows that the government is interested in the irrigation question. Referring to the question of irrigation education, Mr. Dawson spoke of the work along this line done by the Canadian Pacific Railway in Alberta, by the federal government, and by the provincial government, the latter establishing farms where half the work was done under irrigation and the other half by dry farming methods, all three having in the past printed and distributed bulletins dealing with the subject. Irrigation in Alberta was unquestionably a success. As a means of further education, he suggested attendance at the next convention of the Western Canada Irrigation Association to be held at Maple Creek in August 1922. He mentioned further that during the past three years the gross returns from the districts under irrigation from the farms being irrigated were $50.00 per acre, and from these farms not irrigated practically nothing.

The Coal Situation of Western Canada

In the absence of R. DeL. French, M.E.I.C., engineer of the Lignite Utilization Board, his paper entitled "What about Western Coal?" published on page four thirty-three of the August Journal, was read by William A. Davidson, M.E.I.C., superintendent, Rosedale Coal Company Limited, Rosedale, Alta.

A paper on the coal situation of Western Canada was read by William Pearce, M.E.I.C., of Calgary.

Coal Fields of the Four Western Provinces.

Having been requested to open the discussion on the very interesting paper presented by Mr. French regarding the coal fields of the four Western provinces of Canada the writer would begin by saying that papers of the nature this is being so bristling with statistics, the average individual cannot readily grasp them if his only resource is hearing them read. The writer has therefore thought it well, in fact it is necessary in this case to place the observations in the form of a paper, and accompanying and illustrating that paper the writer begs to hand in certain graphs prepared some time since, namely:—

Graph No. 51, which shows what the writer thinks will probably be found one of, if not the greatest area of bituminous or higher grade of coal land in one continuous field that may be found in the world, largely in Alberta, but embracing also a portion of South Eastern British Columbia.

Graph No. 51-A shows a calculation made by the Geological Survey of Canada of the amount of coal in that field. It gives a description of the field, boundaries and area and the estimated amount of the coal in it. The area is 3377 sq. miles or 2,616,000 acres. It will be observed that there are 45,160 tons per acre or 1,037 tons per square foot or an average thickness of 24.7 feet, assuming the cubic feet of coal in situ as 84 lbs. Also that taking the total consumption of coal in Canada for 1917, the latest year the writer had the statistics available at the compilation of this graph, which consumption was 33,171,000 tons this field has a quantity 2,943 times that amount, so that we need scarcely fear a dearth of bituminous coal so far as Canada is concerned.

Graph No. 59, is a map showing the various fields now being operated in Alberta and the output of each field for 1920, and where it went to. It like any other graph which attempts to show a mass of information can only be readily grasped by considerable study. It is submitted that the data as presented is fairly clear, but to make it of value requires sufficient study to familiarize oneself therewith so that one can readily turn to any particular data that might be desired. Feeling that No. 59 was rather too full for the general reader the writer prepared No. 59-A, which probably is as full as the average individual would desire. There is nothing in it that is not in No. 59 and there is a good deal in No. 59 which is not in it, but the presentation is somewhat different.

Should anyone who takes sufficient interest in the subject to attempt to understand it intelligently write for them, any one of those graphs or all of them will be sent him. The writer makes advisedly this condition because experience has taught him that many people will make verbal requests who would not go to the trouble of writing for them. If they are worth having they are certainly worth a written application.

A graph has been prepared showing from the period 1886 to 1897 inclusive, the last dates at which the writer had when the graph was completed on the 25th June, 1919, all the data then available regarding the production, importation, exports and consumption of coal and coke in Canada. It is the intention of the writer, so soon as he can get the time to carry that down to the latest possible date, to continue that in the future. If anyone who takes enough interest in the subject will apply to Col. J. S. Dennis, M.E.I.C., commissioner Department of Colonization and Development, C.P.R., Montreal, that gentleman will probably authorize the writer to send it to him. The said graph also contains the coal resources of the world, based on the report of the Twelfth International Geological Congress held in Canada in 1913.

Observations are confined altogether to Alberta and South Eastern British Columbia coals. The writer might say in passing that he does not agree with the conclusions arrived at by Mr. French that it is advisable in this discussion to ignore the coals of B. C., at least those in the South Eastern B. C., which field is contiguous to Alberta and is really one and the same bituminous coal field. Those coals in B. C. according to estimates made by the Geological Department of Canada equal 53,582,540,000 tons, the total coal resources of bituminous coal in Alberta is equal to 219,203,000,000 of which 20.08% or 44,029,642,000 tons lie within the area covered by graph. No. 51. The total amount of bituminous coals in Southern Alberta and South Eastern B. C. combined equals 97,612,002,000 tons.

The Thermal Value of Coal

From tests made by the Economic and Development Commission of the Province of Alberta they have graded the lignite coals as follows:—

No. 1 Lethbridge.
No. 2 Taber.
No. 3 Drumheller.
No. 4 Pembina.
No. 5 Edmonton and vicinity.

Judging by their B.T.U.'s is after all only an approximate manner of ascertaining their true values. There are many elements which come into play in the composition of coals which tend to create conditions that for using them for general heating purposes render the thermal valuations often most misleading. It however is probably the best single means of judging coal, provided of course that the said values are all ascertained under the same conditions. Unless great care is taken in making the tests those coals which have high moisture content the B.T.U.'s may prove most erroneous.

No. 1 has a B.T.U. value of 11.710
No. 2 " " " 11.040
No. 3 " " " 9.650
No. 4 " " " 9.040
No. 5 according to statistics furnished are 11.000.

It will be observed that that grading based on B.T.U. does not coincide with the grading arrived at by the said commission, and no doubt the commission grading is the more nearly correct.

While on the subject of B.T.U.'s it might probably be well to take up those of our bituminous coal, so far as statistics on that point are available. The writer has divided them into the following fields:—

(1). Those which are classed as anthracitic, being those North of the Bow River field at present being operated at Bankhead.

(2). The coals in the Bow River Basin, Canmore and below.

(3). That portion of the mines along the Crow's Nest Pass Railway in Alberta.

(4). Those mines along the railway in B.C.

(5). Samples of coal which were analyzed by the University of Illinois recently, (6 samples) (a). Canmore (b). The Gap. (c. d. and e.) on the Elk River in B.C. (f.) McGillivray Creek, Alta.

(6). The Brazeau Coal Field.

(7). Mountain Park, Yellowhead Pass and Jasper Park.

No. 1—6 samples analyzed gave a B.T.U. value of 12.882.

No. 2—5 samples analyzed gave a B.T.U. value of 13,672.

No. 3—24 samples analyzed gave a B.T.U. value of 12.135.

No. 4—15 samples which have a B.T.U. value of 13.338.

No. 5—6 samples gave a B.T.U. value of 13.100.
No. 6—1 sample gave a B.T.U. value of 13.155.
No. 7—3 samples gave a B.T.U. value of 12.458.
Of that however it might be stated that one sample, namely Mountain Park gave 14.210.

It might be here mentioned in reference to No. 5 that 3 of these samples were taken from some exploration workings which have been standing years, 10 or more, and considerable water had accumulated in two of them. the action of such water had probably lowered the B.T.U. value considerably. It might be observed that in those two the ash content is very much higher than the average analysis of those made at the time the workings were made and also of coals in that vicinity.

It will thus be seen that taking 13,000 which Mr. French states is the average in B.T.U. of American steam coal, we have in Alberta an inexhaustible amount of coals which will attain or surpass the average of the American.

Production of Alberta—See Graphs 59 and 59-A

In the following the percentages are based on the total production.

According to the returns of the Department of Mines for the Province of Alberta the total production was 6,894,139 tons of which 3,347,012 tons or 48.52% of the total output was lignite, the balance 3, 547,157 tons or 51.48% of the whole in bituminous and anthracite combined. The anthracite however represented 1.9% of the total output.

As to the distribution of those coals.

Of the total production of lignites 91.26% were sold. The Drumheller field represented 37.22% of the total sales. Lethbridge 24.38%. Cloverbar 10.35%. Cardiff 5.36%. The balance, fully 25 fields were under 5% and all combined equaled 22.69%. Those sales by the fields in Alberta were as follows in the sequence already given. The percentages being based on the total output 4.01%—3.15%—4.04% and 2.12% a total of 13.32% out of a total of 16.06% sold in that province. For Saskatchewan they ranked as follows:—7.96%—5.75%, 0.38%—0.21% a total of 14.30% out of a total of 16.20% sold in that province of this class. In Manitoba they ranked 4.18%—1.23%—0.14%—0.03%—5.58% out of a total of 6.38% sold in that province of that class. In B.C. 0.75% from Drumheller 0.20% Lethbridge, 0.28% Pembina, 0.18% Taber, 0.07% and Clover Bar 0.02%.

Turning now to the bituminous and anthracite. The total production of the two combined was 51.48% and the sales 49.21% of the total production the latter being 1.9%. Of the total sales namely 3,396,144 tons 2,608,734 tons were sold to railways, the sales to railways being 37.84% of the total production. Of that 15.62% were sold in Alberta, 15.42% Saskatchewan, 4.36% in British Columbia and 2.44% in Manitoba. There was sold of bituminous and anthracite coals for other than railway purposes 787,412 tons or 11.42% of the total production. Of that 11.42%, 4.01% was sold in Alberta, 2.55% in Saskatchewan, 2.09% in Manitoba, 1.67% in U.S. and 1.08% in B.C. Combining the sales to railways and also for other purposes of bituminous and anthracite there were sold in Alberta 1,353,031 tons or 19.66% of the total production, and in the same province the total sale of lignites was 1,370,595 tons or 19.89%. Of the total production in Saskatchewan there was sold of bituminous and anthracite 1,339,024 tons or 19.42%. Of the total production there was sold 1,134,416 tons of lignite or 16.45%. Of the total in Manitoba there was sold of the bituminous 312,453 tons or 4.54%. Of the total to the B.C. there was sold of the bituminous 375,691 tons or 5.45%. Of the total of the lignite 54,116 tons or 0.78%. Of the total to the U.S. there was sold of the bituminous 115,415 tons or 1.57% and 25,497 tons or 0.37%, which was taken wholly from the Lethbridge field. To recapitulate, lignite exceeded bituminous in sales in Alberta 17,564 tons and in Manitoba 143,945 tons. In Saskatchewan bituminous exceeded the lignite 204,608 tons. In B.C. 321,537 tons, and in U.S. 89,918 tons. The total sale of bituminous over lignite was 441,841 tons. So much for production and sales.

There is no doubt whatever that a combination of collieries would very much decrease the cost of production. It however, is probably a matter that the genius of our people may not permit to be faced at present and will have to be left to work itself out. When things get down to normal so far as general costs, labour, supply etc, are concerned these matters will likely rectify themselves. It will probably be a case of the survival of the fittest.

Cartel

There is no doubt whatever that all interests would be improved if there could be some agreement arrived at between the owners as to where should be the market for their respective outputs. A thorough grading of coals so that the consumer would be certain of the values of the coal he is buying would also add greatly to satisfactory conditions in this trade. If it were possible to grade coals as accurately as we grade wheat it would greatly improve conditions, but there is a huge personal factor in the use of coals for domestic purposes. We have all met people who said certain coals were better than others when we knew by every competent test that it was possible to be applied that such was not the case. The undersigned has met many people now living in B.C. who lived in Saskatchewan and had been accustomed to burning the lower grade of Souris lignites, who assert and believe what they are asserting that the Saskatchewan lignites are for household purposes superior to the best coals obtained from Vancouver Island. There is one thing that our coal dealers and manufacturers or appliances for burning coals have been woefully lacking in, and that is to educate people how to best use the coals they are utilizing. Probably the best illustration of the value of such education may be by reciting the following:—The Minnesota Coke and Gas Co.,of St. Paul, finding itself about two years ago with about 200,000 tons per annum of coke on hand, which they had formerly disposed of to smelters, but suddenly lost that trade, engaged about a dozen young men, erected a building and put therein every appliance utilized in St. Paul and Minneapolis in the burning of anthracite, and had them utilize them till they were thoroughly conversant with how to burn coke to the best advantage in the various appliances. It then turned them out to sell coke in the Twin Cities, first placing a spread of $3.00 per ton between coke and anthracite, in a very few days that was reduced to $2.50 per ton, shortly after to $2.00 per ton, then to a $1.00 per ton and last September stated it thought it would be able during the winter of 1920-21 to sell it at the same price as anthracite. These salesmen placed themselves at the disposal of the customers night and day until the customer was thoroughly familiar with the combustion of coke in whatever appliance he was using. If they were telephoned for, no matter at what hour it was their business to reach the customer as quickly as could be and assist him out of his trouble.

According to the coal resources of the world as per report of the Twelfth International Geological Congress which assembled in Canada in 1913 the coal resources of the world were divided into four classes a. b. c. and d. (d.) corresponds to our lignite. (a.) to our anthracite coals, and (b. and c.) are bituminous varieties.

It will be noticed however on reference to the schedule produced by it that the B.T.U's are based on dry quantities. In other words the moisture is eliminated in working out the B.T.U's. According to that report; Alberta had 14.53% of the world's tonnage and 87.1% of the total tonnage of Canada. This however, is largely estimated and the probabilities are that the estimates are considerably too low. Of Alberta's total 36.19% was actually known and the probable was the balance of the 100% namely 63.81%. Of the actual 0.062% was anthracitic, of the bituminous 0.299%, and of lignites 35.83%, of the probable 63.81% the anthracitics were estimated at 0.0093%, bituminous at 18.14% and lignite 45.65%. Since that estimate was made very many beds of bituminous have been discovered, and from the discoveries made it is estimated that of the anthracite and bituminous there was 219,203 million tons,and of that in the area defined in graph 51-A South of the Northernly limit of township 26 there are known to exist 44,019,642,000 tons, and in that portion of B.C. lying adjacent to the Southern part of Alberta there are 53,582,540,000 tons, which added to the portion in Alberta immediately adjacent to the East makes 97,612,182,000 tons. That portion of Alberta North of township 26 contains the balance of this class of coal as belonging to Alberta at which total for Alberta is estimated at 219,203,000,000 tons. In discussing the matter of coals however it probably would be advisable to confine it to those coal beds which are now furnished with railway connections. Under existing circumstances because of the immense volume of high grade coals, probably as high in quality or very nearly so, as any that may lie elsewhere, it would appear probable that it will likely be some time before there are further extensions of railways to furnish coal. It is probable that the coal fields of South Eastern B.C. are the largest single bituminous coal fields in B.C. and probably some of those on the Elk River above Michel River are for lump coal the best in that province.

From recent development however it would appear that probably on the Peace River above Hudson's Hope and its tributaries in B.C. there are very extensive areas of bituminous coals. It is asserted and probably correctly that large areas lying North of the C.N.R., and G.T.P. in the drainage of the Smoky River are of very high grade, but probably they may not be developed for many years, there being no occasion for such outlay in development.

Would it not therefore seem probable that it would be good business in the matter for the Province of Alberta and those representing the South Eastern part of B.C. that they should devote their attention largely to the development of their bituminous and anthracitic coals now lying available to railway connection?

It is thought that the best way to develop that is by by-product ovens, making a good domestic coke carrying say 10% volatile which even under present oven practice it is thought can readily be made to carry that percentage. Such coke would not suffer materially from abrasion in handling nor deteriorate by exposure to the weather and lends itself to storage, thus enabling it to be handled at any season ot the year, which in turn produces cheap transportation.

In the by-product oven process a large amount of binder will be produced and that binder can be used for briquetting any of the breeze which may arise from handling of the coke and for the briquetting of coals which will not readily coke, which coals are very high in fixed carbon and low in ash, and should produce an ideal briquette. It might however be mentioned here that recent investigations has shown that many coals which under ordinary bee hive coke oven practice will not make coke; if mixed with the coking coals which lie in their vicinity will produce under by-product ovens a very good grade of domestic coke.

We shall now take up the question of the fixed carbon and ash of the coals under discussion, from which one can deduce with approximate accuracy the class of coke that will be produced.

Taking the fields as already defined.

No. 1—In the 6 samples the average percentage of fixed carbon is 73.6% and the ash 13.9%.

No.2—Five samples, fixed carbon 73.2%, ash 7.6%.

No. 3—22 samples gave an average of 56.341% fixed carbon and 16.460% ash.

No. 4—Along the Crow's Nest Pass in B. C. 15 samples gave an average of 64.269% fixed carbon and 10.49% ash.

No. 5—Six samples gave an average of 63.73% and 12.7% ash.

No. 6—Fixed carbon 61.35% and 3.61% ash.

No. 7—Three samples gave an average of 59.4% fixed carbon and 15.7% ash. Of that however the sample Mountain Park was reported as 62.6% fixed carbon and 4.3% ash.

From the foregoing quantities as given, and adding say 2% moisture in douching, which will not injure it for the purpose desired it appears certain a very high grade of domestic coke should be produced and the percentage of such coke produced should be very high.

By-Product Oven Practice

There are two distinct types of by-product oven, the high and the low temperature. The latter however has not so far as this continent is concerned been installed in sufficient numbers or of sufficient size to warrant one to base largely on it without further experimentation; but it seems highly probable that it will in time be valuable particularly where the by-products are of very considerable value. It is reported that Germany has done a great deal in low temperature by-product oven practice since the beginning of the Great War, it being desirable, in fact almost vital to its existance that it should be able to produce within itself the necessary fuel oils and motor spirits, and there is a popular opinion that it has made great progress. It is further stated that they have been able to extract both the substances mentioned from their brown coals. It is difficult to understand however why they should have taken to the brown coals, unless they found that they were more profitable for the articles desired than those of the higher grade coal. During the war they not only had access to all their higher grade coals but also to a very large percentage of those found in France. There appears to be however no doubt of one thing, that what Germany has done in the way of the use of her brown fuels has been very much exaggerated. According to the coal resources of the world already quoted, the lignite of Germany represented only 6.7% of the total coal resources and so far as the undersigned can gather it is no doubt probable that they have been largely used for domestic purpose, but it may be open to question whether they have been for by-product oven practice. The undersigned has been striving for upwards of a year to obtain some data regarding this particular point of Germany by-product oven practice, but so far has obtained nothing that is at all reliable. If Germany's lignites are so extensive and valuable in by-products and fuel why such strenuous contests for the Alsace, Rhur Basin and Silician bituminous coals?

It would appear however as absolutely certain that all the by-products that can be readily and economically obtained from our coals should be. Some go as far as to assert that the value of the by-products will more than compensate for the cost of coking. Be that as it may, there is probably no doubt that, if not already, in the not distant future the enhanced value of the coke produced together with by-products will very much more than compensate for the cost of production.

Those by-products may be resolved into the following. By high-temperature process there would be a large amount of gas. By low-temperature probably not more than is required for operation of the plant, so we shall omit the gas, there remains the sulphate of ammonia, very valuable as a fertilizer, the binder valuable for briquetting, the motor spirits utilized as gasoline; the fuel oils, the creosote oils as a timber preservative, the tars which can be used to advantage for many things, and the residues which form good roads binders for preventing dust, and to some extent from cutting up travelling on it when wet, in other words form a first class crowning material to shed the rain. That does not take into account the valuable dyes, explosives etc., that can be obtained from the by-products of coal. It probably is premature to think of extracting the last named by-products out of the tars by fractionizing them.

It may be that our lignite may prove as valuable for briquetting and by-product oven practice, possibly the production of coke, as would our true coals. Regarding the carbonization plant to furnish briquettes at Bienfait, Sask., it is stated on good authority that it is not contemplated attempting by-product oven practice on those coals for the present, and probably not for some years, not even to strive to obtain a binder from them. The amount of binder that will be required for them is said to be 10% and the nearest point in Canada at which there can be obtained a coal binder would be Sault Ste. Marie. The freight rates on that as at present would probably equal at least $9.00 a ton, 10% of that would be 90 cents, which would be the cost of freight on the binder. If by-product ovens were instituted in Alberta, the cost of the binder to that plant could be very materially reduced. One would be very rash to prophesy what the future might have in store in connection with our lignite coals with the treatment by by-product or from some other similar practice, but would it not under ordinary business prudence be advisable to take a class of coal that we know fairly well how it will respond to treatment, rather than with something we know nothing about, and if investigations shows that we can profitably utilize our lignites under some treatment than devote attention to them? So far as Alberta is concerned the cost of transportation to the consumer we are particularly desirous to send to from our main lignite reserves has in mileage very little advantage over our true coals, but when the values for fuel purposes of the two are compared our bituminous coals have a decided advantage in the matter of freights. So long as there is reciprocity in coals between U.S. and Canada, and there seems no prospect of a change in that regard might it not be possible to extend our market of coke and briquettes into the Western U.S. to a very large extent? That country has a very limited supply of true coals North of the line of the Union and Central Pacific Railway so that Canada possesses a large territory in the U.S. already served by railways, which is nearer its coal fields than it is to the same class of American.

It is reported that in England as high as 40 gallons of fuel oil which comes up to the standard required by the British Naval authorities has been obtained from each ton of coal. Assuming only obtaining 40% of that amount imagine what a fuel supply we could furnish to the Pacific if we treated say half our present output namely 3,500,000 tons, which at 16 gallons to each ton gives 56 million gallons or 1,300,000 barrels of oil of 42 gallons each. It is almost absolutely certain that the use of fuel oil will be restricted to marine purposes. Railway transportation will have to fall back on coal or coke in some shape or other and the smoke nuisance is becoming such a huge one that the probabilities are that coke will be necessary to minimize same. If a process can be devised by which good coke can be turned out even in rough sphericals it would lend itself readily for automatic firing of locomotives and other steam boilers.

A colloidal fuel is strongly advocated by many, and it may be the oils and tars obtained from our coals through by-products ovens would find a very good and profitable market.

In conclusion the writer would like to state if anyone reading this paper or examining the blue prints, comes across anything that it is not clear to him, he will if written to, be only too glad to try and make it clear. Also if there be any conclusions with which he may disagree, the writer would be most happy to discuss it, as it is desirable that the fullest information on this subject should be attained. Further the writer would be greatly pleased to have any errors pointed out. There are possibly very many.

Discussion

W.Nelson Smith, M.E.I.C. opened the general discussion on this subject by asking Mr. Pearce why he felt discouraged regarding the use of pulverized coal, which apparently offered good possibilities. Mr. Pearce replied that in his experience pulverizing of the Western lignites has not been a success, that where pulverized fuel was successful it was mostly high grade anthracite.

In the discussion which followed several cases were cited of the successful use of pulverized fuel at the coast for industrial purposes. Mr. Pearce pointed out that the problem of the prairies was that the cost of removing the moisture from the lignites prevented its use for domestic purposes, and that considerable knowledge was yet needed on the subject of the utilization of pulverized fuel.

This morning session then adjourned.

Water Powers of the Prairie Provinces

Afternoon Session, Thursday, August 11th, 1921,

Under the Direction of the Winnipeg Branch.

E. P. Fetherstonhaugh, M.E.I.C., Chairman of the Winnipeg Branch, occupied the chair.

The programme called for a paper on the general policy of the Manitoba Power Commission by J. M. Leamy, M.E.I.C., commissioner, but in Mr. Leamy's absence the paper was not available. The next paper on the programme was read by the author, J. Rochetti, M.E.I.C., chief engineer, Manitoba Power Commission being: "Economics and Engineering Features of the Manitoba Transmission System." This paper will be printed in a future number of The Journal.

C. H. Atwood, A.M.E.I.C., the author of the paper on this subject, was unable to be present, and in his absence Arthur L. Ford, A.M.E.I.C., read the paper on "The Water Powers of the Prairies Provinces", dealing with resources, administration and market, as published in the August Journal, commencing page four thirty-seven.

Discussion

Following the reading of Mr. Atwood's paper, a brief discussion arose over the possible head of water powers in the prairie provinces. Replying for Alberta, Mr. Ford stated that they would average seventy feet, and one water power was under investigation which might have a head of eleven hundred feet. Mr. Smith of Winnipeg expressed his belief that the control of the water powers in the prairie provinces was rightly under the jurisdiction of the Federal Government. He paid a tribute to the work of the Dominion Water Power Branch, Department of the Interior, which was being conducted in an efficient manner. As an instance of the value of the present arrangement being continued, he spoke of the regulation of the Lake of the Woods which affected Manitoba, Ontario and the United States, the settlement of which was rightly in the hands of the International Joint Commission. Mr. Ford, Mr. Pearce and the chairman concurred in the opinion expressed by Mr. Smith regarding the control of the streams being continued under the jurisdiction of the federal government, and the chairman also paid a tribute to the work of the Dominion Water Power Branch.

Northern Territory in Western Canada, its Development and its Problems

R. C. Wallace, Ph. D. commissioner of Northern Manitoba, then read his paper on the above subject, dealing with the resources, mineral and agricultural, transportation by light railway and motor truck, and financial problems of the Northern Territory as published in the August Journal commencing page four forty-four.

Discussion by W. T. Thompson, M.E.I.C.

The subjects referred to by Professor Wallace are of vital importance to the people of the West. The comparatively recent discovery of rich mineral deposits, especially in Northern Manitoba of oil at Fort Norman and other points in the Mackenzie River basin, has certainly focussed the attention of prospectors and capitalists on our North country, also as the best of the free homestead land in the open prairie has now been taken up settlers are rapidly pressing Northward into the bush country and apart from the labour of clearing the land, this country certainly possesses advantages over the arid portions of our Western plains. In timbered country there is always more rainfall, an abundant fuel supply; protection from the cold winds of winter and the hot winds of summer which at times sweep over the open plains with very destructive effect on growing crops; also in bush country a good water supply is usually to be had at a very moderate depth while on the open plains in certain areas the obtaining of water is a serious problem. That we have large areas of excellent land in the bush country there is no question. Having recently come in contact with some settlers from Minnesota and Iowa who have resided for some years in the bush country of this province, on enquiring how the land compared with the land of those states the reply was, this is a great country and there is no soil anywhere better than we have here, adding that if grain prices had not fallen so low there would have been a great influx of settlers from South of the line this year. We certainly have a great heritage in the mineral deposits; water powers, timber; fisheries and agricultural resources of our north, and of those the mineral deposits are probably our greatest asset. Northern Canada from the Atlantic to the Pacific and Northward to the Arctic Ocean contains, it is believed by geologists, the largest area of unprospected mineralized territory is the world and as it is reasonably certain that the rich finds of gold and copper ores recently discovered in Northern Manitoba will be duplicated at many other points where rocks of similar formation are known to occur, this Northern region will offer a most inviting field to the prospector when suitable transportation facilities are available.

Referring to the mineral deposits of the Northern portion of our sister province of Manitoba a sketch by the author of this paper will be found in the bulletin published by the Manitoba Government, entitled "Mining and Mineral Prospects in Northern Manitoba" which contains also a bibliography of books, papers and memoirs relating to the subject.

Transportation by means of light railway from important centres to mining camps will no doubt suffice for local traffic and the use of hydroplanes in a country where there are so many lakes and rivers should prove of great service; also communication by means of wireless telephone will be a great boon to the people of the north, and results from the two units now being installed will be looked forward to with interest.

The summer isothermal of sixty degrees heads far to the North and as in spring and summer the period of sunlight increases as one advances Northward, plant life matures more quickly and as areas of good land extend far down the valley of the Mackenzie it is probable that farming operations on a limited scale may be probably carried on even in that remote region.

In the development of our resources transportation is the most vital problem. To quote from the paper, "Without reasonably cheap freight charges development is uneconomical." This is certainly true and to reduce these charges we must reduce our railway mileage to the sea board. The International Water Ways Commission has in view the deepening of our canals so that ocean vessels may pass Westward to the head of the great lakes, and while this project will involve the expenditure of a very large sum of money, it is backed by powerful financial interests in Eastern Canada and the United States and will doubtless in time be carried out, but when this is done it will only give a measure of relief to the Southern portion of the North West, while for the North Professor Wallace in various bulletins and reports has called attention to the importance of rail communication with Hudson Bay and looking to future development this would seem to be desirable to several ports upon its coasts with a line Westward passing through the fine Peace River country. This great inland sea—Hudson Bay—washes the shores of our Northland inviting us to utilize its waters. Let us accept this invitation and urge the early completion of the Hudson Bay Railway and the opening of the Hudson Bay route which will reduce the railway mileage to an ocean port from the Pas—the gateway to Hudson Bay and the Northland—by over 1500 miles, provide direct access to the great ports of Europe and form a new bond between this great Western section and the heart of the British Empire—that little island across the ocean, the centre of commerce of the world.

Discussion by Lt. Col. A. C. Garner, M.E.I.C.

In reading over Dr. Wallace's paper one is forcibly struck with the broad, complete, and comprehensive outlook of vision of the author and how truly the paper conforms to its title.

Dealing with the first heading "The Northern Outlook"—it is true that a rapidly increasing interest, practically dominion wide, is being taken by the genera public and those in authority that a very urgent and res ponsible duty has been upon them, viz., complete and accurate research work and the evolving of methods whereby our natural resources can best be developed and conserved and to insure that the public is at all time correctly informed.

Respecting Stefansson's views of the possibilities of the "Barren Lands"—you will probably have noticed in the Canadian papers towards the end of June that he has already taken "time by the forelock", has organized a company with sufficient capital to effect his scheme, and that he has established his base as Vancouver.

Here the writer would like to ask Dr. Wallace's views as to the feasibility of in some way banding together those men having vision, first hand knowledge and experience and those who are engaged on research work etcetera, so that then something worth while is discovered, irrespective of province, or whether we have our natural resources or not, (the writer refers to those provinces which do not at present control same), this group could then get prompt and material action towards development along right lines.

At present there appears to be no concerted action, co-operation, or co-ordination; the results that may accrue are obvious.

The writer is of the opinion that each of the five Western provinces in the undeveloped portions of same each have possibilities equal to if not much greater than those of the "Barren Land" and as against the latter, close to one's doors.

Manitoba has immense known possibilities, both in mineral and water power—little is known of Northern Saskatchewan as compared with either Manitoba or Alberta, but there is no reason to doubt that it may be equally as rich as Manitoba, there are more than sufficient water powers to satisfy any local demands that might be made upon them and in so far as known this province is rich in natural resources.

Alberta is similarly rich in natural resources to Manitoba and Saskatchewan and has at the present great advantages in having immense coal fields and the possibilities of "one of the largest of the world's oil fields." Similarly Northern British Columbia has no doubt great possibilities, but more difficult of access than the prairie provinces.

While the possibilities of (at least) Manitoba, Saskatchewan, and Alberta as to pulp wood are small as compared with those of Eastern Canada, there are large quantities of timber of great value to each of these provinces for internal domestic purposes, etc. There are also immense quantities of building material which when transportation permits will be of great value. Respecting agricultural possibilities, it is doubtful if these may be counted upon on any large scale beyond the 54th parallel of latitude, but there are sufficient areas of very rich soil either at or near to any point where mining may develop on a large scale, to supply the needs of the population with at least seasonable garden truck. The possibilities in this respect are known.

Can we not therefore say that the "Northern Outlook" as to the possibilities of the four most Western provinces is not only bright but also most promising and we can make this statement confidently and without being accused of excessive optimism.

Northern Resources

Dr. Wallace has fully outlined our known possibilities under this heading and the concrete case of the "Flin Flon Mine" is clear and will be readily grasped by all who may have the good fortune to read this paper. Indirectly the writer is somewhat familiar with this particular case and can confirm Dr. Wallace's statement. The writer has also touched on valuable resources that will be developed during and in the wake of active mining operation furnishing transportation facilities. It may not be out of place to mention here that all the Northern waters abound with fish of excellent quality and marketable varieties. With respect to "wild life" and fur bearing animals, these will be appreciably affected, but differently to "the old order of things" for no doubt as the country develops, large natural parks will be set apart, for the care, conservation, and shelter of "wild life" and the science and experience being and to be obtained respecting the care, propagation, etc., of valuable fur bearing animals in a state of captivity will to a large extent take care of our valuable fur bearing animals, so that this phase of the situation is not so serious as it would seem to appear.

In passing from this to the next subject do not think the writer is incorrect in broadly stating that some of our Western provinces are "self contained," that is to say they contain all that man requires within reasonable limits in their respective boundaries when full development has been attained.

Transportation and Communication

There are many home truths in Dr. Wallace's statement under this heading, the days of railway construction merely to develop new territory are gone for some years to come unless minerals for general utilization by the public can be found in large enough quantities, such as coal, etc. Alberta will possibly not experience much difficulty in this respect especially if the oil fields develop as anticipated. This brings us then to consider the possibility of a line or lines connecting Alberta Northern system of railways with the Hudson Bay, across the Northern portions of Saskatchewan and Manitoba, thereby economically developing these areas, bringing the "Barren Lands" within reach of rail, accentuated Stefansson's schemes, greatly increasing the need and value of a port or ports on the Hudson Bay and development of the short ocean route from thence to England the "Soul of the Empire".

Light Railways

With respect to light railways, there is no reason why these could not be used to great advantage, even if only as advanced means of transportation and the economic development of outlying prospects. It was the writer's good fortune to have over a year's experience with light railways in France; this was the same system which linked up broad gauge railheads with the front line, supplying all its requirements and spreading out fanlike from railhead to within a thousand yards of the front line.

Light railways are easy of construction, economical in operation and would very well satisfy requirements until broad gauge was warranted. The little the writer have seen of Northern territory leads him to the conclusion that this lends itself to easy construction, in many parts a stable and permanent road bed could be secured with good natural drainage and in the main the necessary road building materials may be found right at hand. The building of motor truck of the equivalent in three first class wagon roads, would probably be almost as expensive as construction of broad gauge railways and certainly more expensive than construction of light railways. Road schemes might very well be worked out by building waggon or motor truck roads of light railways along lines that would in the main be suitable for broad gauge railroads at a later period.

The development of water ways should also be given consideration, there are main water ways linking at least Saskatchewan and Manitoba that could be developed for commercial purposes at comparatively reasonable cost. The hydroplane will be valuable and economic for reconnaissance purposes and as a rapid means of transportation when and where large centres are established, for freight carrying purposes it is at the moment a question of "wait and see". Installation of telephones, (as Dr. Wallace rightly remarks,) would be a godsend to those at present resident in the wilds and very materially assist in research work and development and also in the greater conservation of our natural resources, particularly with respect to our forests. The writer is sure we shall all be pleased to hear more from Dr. Wallace as to the "wireless telephone", its advantages. etc. with respect to the subject matter in his paper.

Aids to Development

This is covered in a very concrete and clear manner by Dr. Wallace. The crux of this portion of his paper may be said to lie in the following statement made by him, "What is now demanded, is not so much the description of our Northern assets in general terms, as a clear cut statement with full and accurate details, analysis of revenues and general market conditions for each particular asset, whether mineral, timber or water power, in order that the business man may appraise the case without undue loss of time. In other words, it is the function of the provincial authorities to form the connecting link between capital and the latent wealth of the North."

In the meantime the writer feels that much valuable time is being lost and some of our natural resources are either, being wasted, mis-used, or destroyed, through a lack of concerted effort on the part of those concerned in these matters. The writer would suggest that careful thought be given towards bringing about concerted and co-ordinated efforts on the part of each of the four Western provinces and the federal authorities,each working together with "cards on the table" in the common interest. A commission, with adequate representation, and composed of Canadians of the highest ability and integrity may be the correct solution. The writer concurs with Dr. Wallace that we should each give our utmost support towards the settlement and more intensive development of our sparsely settled prairies and the wonderful and rich valleys of British Columbia. This will materially aid and hasten the development of the Northern and outlying portions of our respective provinces.

As engineers the point brought before us by Dr. Wallace and the development of our "natural resources" are not only of vital interest but affect us individually, it is our work, and the public look to us "to make good".

The writer has lived in the Western provinces in question a little over thirty-three years and each year is more convinced of, not only the possiblitilies of these provinces but the dominion as a whole. Probably no country under the British flag holds as great a future provided each plays his or her part. The field for engineers is unlimited but requires patience, study and foresight on the part of each. In conclusion the writer desires to express his full appreciation of the honour conferred in granting him this opportunity of having his name linked with those of Dr. Wallace and W. T. Thompson, men who are not only qualified to deal with the matters of this kind as experienced experts, but who have devoted their lives so far in an effort to assist in bringing about the development of this great dominion and particularly its Western provinces.

Further Discussion

W. A. Begg, A.M.E.I.C., of Regina, thought an improvement might be made in the method of surveying the land for settlers in order that they might be able to live closer together and also be in a better position to maintain roads. He cited Northern Quebec as an instance where instead of quarter sections, the sections were divided into strips, giving each a frontage on the main road, which placed the homes close together.

Major Muckleston, in referring to the use of light railways in the North, suggested that any consideration in that direction should take advantage of the experience given by the officers in constructing light railways in France. Major Walkem was strongly of the opinion that too much stress had been laid on the part played by the miners in opening up the country, as previous speakers had magnified and over-estimated their importance in connection with opening up and settling the country. Dr. Wallace believed that whatever farming was done would be in the nature of ranching. He did not advocate the homestead system, nor any attempt to settle the country, which should come naturally. A member mentioned a case of one rancher trying out the possibilities of ranching in the far North, and decided, after a year's experiment, that owing to the long winter it was not possible. Asked regarding the possibilities of the Nelson River Valley, for farming, Dr. Wallace stated that there was an area of 10,000 square miles of clay land suitable for farming after drainage, but he did not think it opportune for farmers to settle there at present. Asked by Mr. Pearce regarding the pulp wood possibilities, Dr. Wallace replied that there were from three to seven million cords of white and black spruce near river transportation, but that any operation would require including the poplar found in the district. A member warned against a continuation of railway development as the country was at present suffering from over-expansion in that direction. Mr. Thompson stated that the Hudson Bay Railroad was graded practically to the terminus. He believed that the Northern route offered splendid possibilities. R. Cunningham, of Winnipeg, stated that he had just returned from Fort McMurray, and believed, on account of the riches of the resources in that country, there was room for further railroad development, mentioning particularly the oil shale and logging possibilities.

At the conclusion of the discussion, on motion by Messrs. Porter and Le Grand, a hearty vote of thanks was passed extending the thanks of the meeting to Dr. Wallace for coming to the Convention and giving such valuable information regarding the North Country.

The Banquet

The official programme of the banquet is reproduced and although it presents the bare facts of the occasion, it gives no indication whatever of the enjoyment the evening provided and the good fellowship which prevailed. All were agreed that the right man was selected when George W. Craig of Calgary agreed to act as toastmaster, his many years' experience as a Rotarian being in evidence in the splendid manner in which he presided. The menu left nothing to be desired; the music was of a high order; the singing was enthusiastic, and the speeches were eloquent, humorous, or both!

The first toast on the list "The Four Western provinces" was proposed by Fraser S. Keith, and responded to by Major Walkem for British Columbia; Major Muckleston for Alberta; Colonel McPherson for Saskatchewan; and Major Fetherstonhaugh for Manitoba. In proposing the toast, Mr. Keith requested the protection of the Chair, since he had umpired a baseball match in the afternoon. He referred briefly to the magnificent prospects awaiting the Western Provinces of Canada, pointed out that Western engineers were largely responsible for bringing about changed conditions in the national engineering organization; that Western engineers occupied high positions and were fitting themselves for even greater; that the West would have the next Annual Meeting of *The Institute*, and he prophesied that the next President of *The Institute* would be a Western man. The witty remarks made from various quarters of the hall during the address of the proposer of this toast led Major Walkem to remark, on rising to reply for British Columbia, that he believed it would take very little to develop the gathering into a rough house. He congratulated the City of Saskatoon, through Mayor Young who was present, as chief magistrate, on being so fine a city; the University of Saskatchewan on its beautiful and excellent buildings, and the Province of Saskatchewan on having created such a modern institution. He emphasized the necessity of engineers taking a more prominent part in politics. Speaking for Alberta, Major Muckleston stated that Alberta and Saskatchewan were twin provinces, Alberta being two hours older. He was proud of the fact that the Calgary Branch was the second to be established West of the Lakes, and that they had initiated, to some extent, the changed conditions in *The Institute*. He was prouder still of their irrigation projects, the magnitude of which were not surpassed in any other country except India. Colonel McPherson pointed out that the bountiful table provided by the University was an evidence of the resources of Saskatchewan; he interspersed his remarks by several witty stories, and referred to the prophesy of the Hon. Walter Scott that Saskatchewan would have a population of 8,000,000 in 1940. When Professor Fetherstonhaugh rose to respond to the toast for Manitoba he received an ovation, led by the Manitoba contingent, all joining in proclaiming him a jolly good fellow. Referring to engineers taking their place in public life, he mentioned that two previous mayors of Winnipeg had been engineers, that the chairman of the Greater Winnipeg Water District as well as the chairman of the Manitoba Power Power Commission was also an engineer. A prominent member of the Branch sat in the city council, and he felt that the engineers in Manitoba were taking a prominent part in public affairs. Before concluding, Major Fetherstonhaugh, as Chairman of the Manitoba Branch, tendered the warmest possible invitation to all present to come to Winnipeg for the Annual General Professional Meeting which would be held there next February.

B. Stuart McKenzie, M.E.I.C., of Winnipeg, proposed the toast of "Our Hosts." He spoke in a highly complimentary manner of the splendid pile of buildings which composed the University, and the engineers loudly cheered their hosts while drinking the toast.

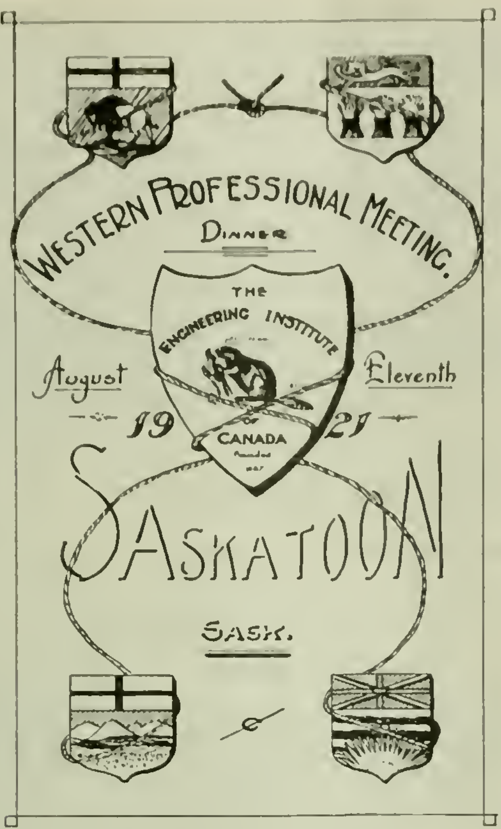
Dr G. H. Ling, acting president of the University, responded to the toast. He expressed regret that Dr. W. C. Murray, the president, could not be present, and greeted the engineers on behalf of the faculty. The greeting was especially warm, he stated, inasmuch as it was a case of college greeting college men. Furthermore, he stated, engineers were men trained for public service, men who devoted their lives for the development of the country.

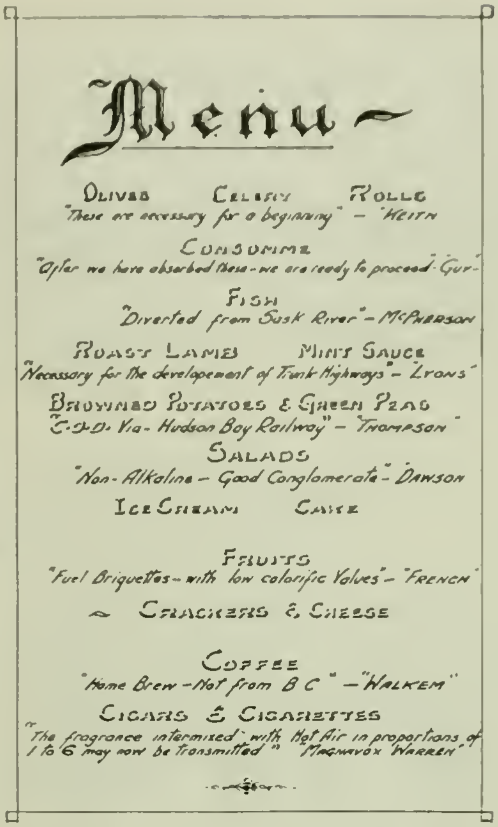
Professional men should co-operate with the universities on problems dealing with their profession, he said, arising in the colleges.

G. D. Mackie, M.E.I.C., of Moose Jaw, proposed the toast to "Our Guests". Engineering is a matter of organized common sense, he stated. In all problems which confront engineers, common sense has to be finally applied before reaching a correct solution. He deeply deplored the fact that there was no license required to practise the engineering profession, as was the case in law, accounting, etc. Anyone, whether a qualified engineer or not, can hang a shingle claiming to be an engineer and be quite immune from the law.

Engineers should seek for legislation in the matter, he declared. Because the engineers failed in their request before the provincial house for legislation this year, he stated, that did not mean that they had ceased striving for it in Saskatchewan, but stated they would keep on trying until finally successful, which would be in the near future, he hoped.

T. H. Wilson, St. Boniface alderman and C.P.R. engineer, and Dr. H. G. Wallace, resident commissioner of Northern Manitoba, The Pas, both made response to the toast. Mr. Wilson claimed that it was essential


Western Professional Meeting.
Dinner
The Engineering Institute of Canada
August Eleventh
1921
Saskatoon
Sask.


Menu

Olives Celery Rolls
"These are necessary for a beginning" – "Keith

Consomme
"After we have absorbed these – we are ready to proceed" Gur-

Fish
"Diverted from Sask River" – McPherson

Roast Lamb Mint Sauce
"Necessary for the developement of Trunk Highways" – "Lyons"

Browned Potatoes & Green Peas
"C.O.D. Via – Hudson Bay Railway" – "Thompson"

Salads
"Non-Alkaline – Good Conglomerate" – Dawson

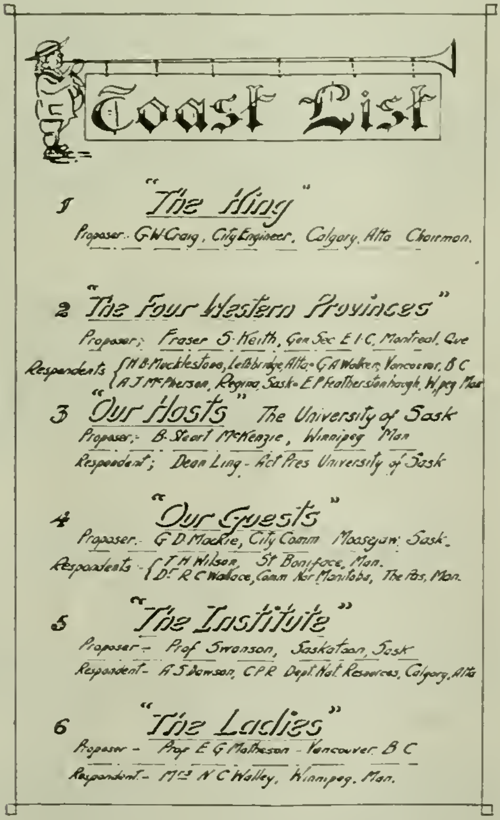
Ice Cream Cake

Fruits
"Fuel Briquettes – with low calorific Values" – "French"

Crackers & Cheese

Coffee
"Home Brew – Not from B C" – "Walkem"

Cigars & Cigarettes
"The fragrance intermixed with Hot Air in proportions of 1 to 6 may now be transmitted" "Magnavox Warren"


Toast List

1 "The King"
Proposer.- G W Craig, City Engineer, Calgary, Alta Chairman.

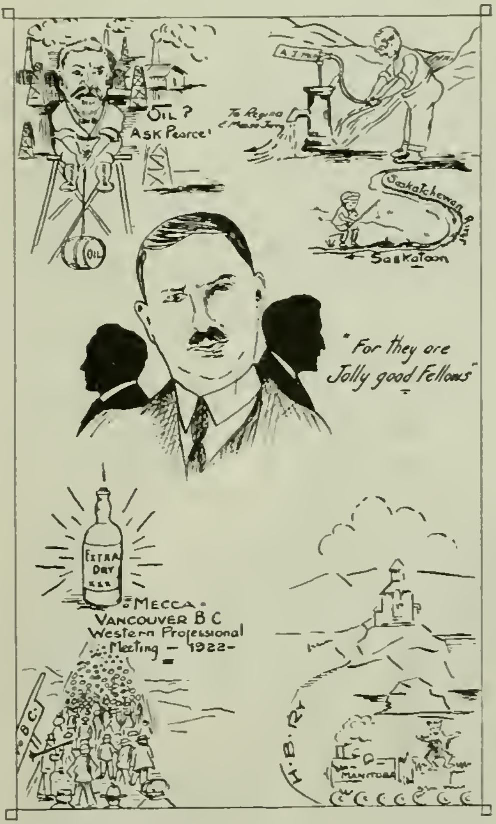
2 "The Four Western Provinces"
Proposer; Fraser S. Keith, Gen Sec E I C, Montreal, Que
Respondents {H B Muckleston, Lethbridge, Alta.– G A Walker, Vancouver, B C
A J McPherson, Regina, Sask.– E P Fetherstonhaugh, W'peg Man

3 "Our Hosts" The University of Sask
Proposer;- B. Stuart McKenzie, Winnipeg Man
Respondent; Dean Ling – Act Pres University of Sask

4 "Our Guests"
Proposer.- G D Mackie, City Comm Moosejaw Sask.
Respondents – {T H Wilson, St Boniface, Man.
Dr R C Wallace, Comm Nor Manitoba, The Pas, Man.

5 "The Institute"
Proposer – Prof Swanson, Saskatoon, Sask
Respondent – A S Dawson, CPR Dept. Nat. Resources, Calgary, Alta

6 "The Ladies"
Proposer – Prof E G Matheson – Vancouver B C
Respondent – Mrs N C Walley, Winnipeg. Man.



Menu, Western Professional Meeting Banquet that engineers should take their proper place in the political life of the country.

Professor W. W. Swanson, Department of Economics, University of Saskatchewan, toasted *The Institute* in an eloquent address in which he paid a high tribute to what engineers had accomplished for the development of the Dominion of Canada. A. S. Dawson, M.E.I.C., of Calgary replied on behalf of *The Institute*. He reviewed the recent changes that had taken place in *The Institute*, outlined its objects and the present situation, and prepicted a greater recognition of the engineering profession on the part of the general public.

"The Ladies", was the final toast on the programme, and was proposed by Professor E. G. Matheson of Vancouver, in which he paid a tribute to the good points of the ladies and pointed out that many of the great engineering undertakings would never have been accomplished except for the tender sympathy and encouragement of the womenfolk. Mrs. N. C. Walley, of Winnipeg, a graduate of civil engineering from Edinburgh University, responded. She received a splendid ovation. She stated that she agreed with a former speaker that engineering was organized common sense, but since her marriage she had discovered that managing a husband also required a great deal of common sense.

Songs in which all participated, solos and orchestral music interspersed the toast list speeches. Following the singing of "Auld Lang Syne" the major portion of those assembled were escorted to one of the reception halls, where dancing was enjoyed for about an hour.

General Welfare of The Institute

Morning Session, Friday, August 12th, 1921.

Major G. A. Walkem, Chairman of the Vancouver Branch, occupied the chair. The discussion on the General Welfare of *The Institute* was opened by W. M. Scott, M.E.I.C., commissioner of the Greater Winnipeg Water District. Previous to the Professional Meeting, the Western Branches had appointed a committee to discuss at this session the general welfare of engineering and Mr. Scott intimated at the onset, as convenor of this committee, that the subject would be given a general discussion, in which he hoped all members would participate, rather than by the presentation of formal papers, as every one was vitally interested, inasmuch as it affected his personal interests. Mr. Scott stated that the engineering profession was composed mainly of university trained men upon whom depended a continuation of the benefit of civilization as far as the material welfare of mankind was concerned. In view of the high standard of service required from the engineer, why did the engineering profession not stand on a par with the other profession? This lack of appreciation is passive rather than active. He mentioned attending a banquet of medical men, at which, in the toast to the sister professions, the engineering profession was entirely overlooked, although their presence there and their comfort was made possible by the work of engineers. The public has a misconception as to what constitutes an engineer, and that is one of the problems before us. A solution depends upon the active co-operation of every member of the profession. On behalf of the committee he presented the subject for discussion under three heads, (1) Legislation (2) Classification and Remuneration; (3) Publicity. Although the headings mentioned would occupy the main topics for discussion, there were many others such as conducting the affairs of a Branch, which were highly important. It had been planned that the discussion under these three headings would be led: Legislation by Lieut. Col. A.J. McPherson, M.E.I.C., Classification and Remuneration by P. J. Jennings, M.E.I.C., acting commissioner of irrigation, Reclamation Service, Department of the Interior, Calgary; and Publicity, Major W. G. Swan, D.S.O., M.E.I.C., chief engineer Board of Harbour Commissioners, Vancouver, B.C.

Legislation

Colonel McPherson introduced the question of legislation from the viewpoint of Saskatchewan, as all other provinces in Canada, with one exception, had already secured engineering acts, while an effort made in Saskatchewan to secure legislation had not been successful. He mentioned the details of the effort to secure an act in Saskatchewan, and enumerated the difficulties encountered. He expressed his opinion that it would be necessary to improve the status of the engineer in the community, independently of legislation. As the engineer continued to develop and improve his status, legislation would come about automatically, and only then would it be effective. He urged strengthening and developing the Saskatchewan Branch of *The Engineering Institute of Canada* as the surest means of improving conditions for the engineer.

Classification and Remuneration

P. J. Jennings, M.E.I.C., in introducing the subject of Classification and Remuneration, said that one of the most perplexing characteristics of an engineer was his general apathy in matters affecting his own betterment, it being a difficult matter to combat or to explain. Co-operation was necessary to accomplish the desired end, and experience had shown that members did not take an active interest in this subject, either through a willingness to let others do the work or because of a feeling that it was a forlorn hope. The engineer has not yet come into his own, but the day was fast approaching when he would receive greater consideration than in the past. The accomplishment of engineers in the world war had greatly increased their status.

Speaking of remuneration, he was gratified to note that recently some of our Western engineers had been given prominent positions at greatly increased salaries. The salaries paid by the government to assistant engineers are inadequate, and left much to be desired. All engineering gatherings should include an effort to increase the status of engineers. In many instances engineers were not receiving remuneration equal to that of skilled mechanics, the policy of the Government in continuing to pay a low price for engineering service being fatuous one. The result of the deliberations of the Calgary Branch Committee, of which the speaker was chairman, appointed to consider this subject, were summarised as follows:—

> **"1. That it was necessary to expedite the passage of suitable protective legislation in all the provinces.**
>
> **2. That the classification and remuneration as suggested in the report of the Engineering Council of the Combined American Societies, dated 15th December, 1919, be adopted.**
>
> **3. That a live publicity committee be appointed with instructions to feed the public, through the press or by other suitable means, with such matter as will bring them to a full understanding of the true nature, character and extent of engineering services.**
>
> **4. That a strong advisory committee, representing every province of the dominion, be called together at headquarters at Montreal with a view to discussing the new schedule of classification and remuneration with responsible government and other officials, and other corporations who are large employers of engineers.**
>
> **5. That a permanent committee be appointed, to be called the Remuneration and Publicity Committee, to keep in touch with all matters respecting this branch of the work.**
>
> **6. That efforts be made to bring about a betterment of the present inadequate protection which the present Act of 1920 affords, not only to the engineers but to the public, and that no efforts be spared to prove its limitation."**

It was found from information secured regarding the salaries paid in Alberta that the average salary was below $2,100.00, which is the minimum amount considered in the Engineering Council Report necessary for the maintenance of a small family.

Publicity-Status of the Profession

This subject was covered in a brief paper by Major W. G. Swan, D.S.O., M.E.I.C., chief engineer, Board of Harbour Commissioners, Vancouver, who stated in a letter transmitted that the brief discussion had been prepared by J. S. McConnell, M.E.I.C., A. E. Foreman, M.E.I.C., and himself. The paper was read by Major Walkem as follows:

General Welfare of The Institute.

Membership

The undersigned are of the opinion that an energetic campaign should be undertaken this autumn substantially to increase the membership of *The Institute.* It is suggested that preliminary steps might be undertaken at once to determine the best ways and means to carry out such a campaign, by inviting the opinions of the various Branches to be sent to a Headquarters committee appointed for this purpose, weighing up these ideas at Headquarters, and remitting to the Branches a summary of the most valuable ideas and suggestions. We are satisfied from our deductions on the situation in British Columbia that much good outside material is available for membership in *The Institute* throughout Canada. To-day in British Columbia we have a total of 318 members of *The Institute*, not all in good standing by any means, while we have 720 registered professional engineers to say nothing of dozens of men who are interested in engineering works and the financing connected therewith and who would make good Associates. In instituting and carrying out such a campaign a note of caution might be sounded to the effect that care be taken to avoid antagonizing other organisations in Canada.

Associates

The total number of "Associates" in *The Institute* is an even dozen, or about 1-3 of 1%. Surely this is not good enough, and are we not missing a very great opportunity of improving our relations with the business and monied interests by failing to have as Associates of our *Institute* employers of engineers, manufacturers, ministers and deputy ministers of public works, railway, canals, lands and interior departments of the dominion and the provinces, general managers and presidents of railway companies, and a score or more of other business classes of the community which are interested in engineering or the product of engineering. We believe this class could be increased to twenty times its present paltry total by a properly concerted effort.

Dues

Closely allied to the membership question is that of dues. The present would, we feel, be a most inopportune time to increase *The Institute* dues. Rather, we think, that by a substantial increase in our membership a reduction of dues might well be effected, and we have to offer this convention the suggestion that dues could be more effectively collected by the Branches, provided, as is suggested below, all members of *The Institute* be attached to Branches. The reasons for this suggestion are, first, the second levy made by the Branches is objectionable and the whole assessment could best be collected at one time, and, second, the Branch Secretaries are in closer touch with the members and we believe the wastage both in dues and members would be less under this arrangement. The Branches would in turn remit to Headquarters.

Branches

We are of the opinion that the best interests of *The Institute* can be served by granting more power to the Branches. As has already been suggested, we are strongly in favour of attaching every member to a Branch. We think under such an arrangement the Council should be elected from the Branches based on a representation more or less according to membership.

Re-Classification of Members

The proposed re-classification of members of *The Institute* would seem to be a step in the right direction and we are of the opinion that the present "members" should become "fellows", the present "associate members" to become "members", and that the student class should cover all junior members who are not eligible as members. If in the future it is desired to raise the qualification of "Fellows", there would be no objection, but we do not think it would be in the interest of *The Institute* to re-grade the present "Members" into two classes.

Fixing Salaries

We believe that the question lies strictly within the province of *The Institute* and that no time should be lost in bringing the work of the "Committee on Salaries" to maturity. For this reason we suggest a paid secretary to this committee should be employed until such time as their report has been completed. We know of several cases within the past six months where a proper salary schedule would have been of decided value and profit to the engineer.

Branch Secretaries

We believe that the work done by the Branch Secretary is such as to warrant his receiving some tangible remuneration for his yearly services. If properly carried out the duties of Branch Secretary carry with them a very considerable amount of labour with the possible exception of two or three summer months. As a suggestion to provide food for thought on the matter we would recommend for consideration a proposal that Branch Secretaries should receive an anual salary amounting to $1. for each corporate member in good standing of his Branch and an additional allowance of $1. for each new member added during the year. We believe such an arrangement or a similar one would tend towards making the secretarial work more efficient and up to date, would be only a fair recognition for work done, and would be an incentive to the Secretary to secure additional membership.

District No 9

We have had in mind that the new oil areas on the Mackenzie River might be added to District No. 10, but as we already have the Yukon Territory attached to the British Columbia District, we beg to suggest that in view of the probable engineering developments of this North Country that the Northwest Territories be attatached to District No. 9.

Offices

Only one more point in conclusion. It has of times been said of *The Institute* that it was run for the glorification of a few prominent engineers. There may have been some grounds for such statement years ago, but we do not believe any such statement can be fairly made to-day. However it is undoubtly a fact that that offices in *The Institute* are occupied too long and too frequently by individual members, no doubt in nine cases out of ten with a view to helping out *The Institute* and frequently because no one else would act. We think it would be a move in the right direction to have a much larger number of our members hold office on Branch or Headquarters executives, and urge that steps be taken to accomplish this purpose.

W. G. SWAN, M.E.I.C.
J. S. MCCONNELL, "
A. E. FOREMAN, "

General Discussion

George W. Craig, M.E.I.C., led the general discussion, and at the onset intimated that it was one which deserved considerable time. He used as an illustration the difference in the manner in which a group of business men—prune brokers for instance—conducted their affairs with a view to tangible returns to themselves, and that of engineers in general, the result showing the inadequacy of the engineer's reward by comparison. He emphasized how much we as engineers missed in advantage from publicity through the columns of the newspaper willing to publish what engineers are doing if presented in form to be understood by the average reader. This offered a big field for the engineering profession, of which we should take advantage. Referring to the status of the engineer in the community, he asserted that engineers were missing a golden opportunity in not taking part in public affairs, the underlying reason for this was due to the fact that the average engineer could not express himself in public, and this, to his mind, was one of the fundamental reasons why the engineer had not the status to-day that he should have. The lawyer, on the one hand, acquires his experience at the time he is receiving his education, while the engineer, with a complete knowledge of his subject, armed with details and figures, generally speaking lacks the facility to make himself clear. As an illustration of the value of learning public speaking when young, he cited the case of a schoolmaster who conducted debating classes for his students, the result of which was that many of them climbed to national eminence, the primary reason for which was their ability to speak in public. It was necessary to decide whether we would be leaders or followers. Usually the leader was a man capable of expressing himself in public, and we as a class were followers. While some engineers took a prominent place in such organizations as commercial, Rotary and Kiwanis clubs, most of us did not. Engineers should take a more prominent part in such organizations. Our engineering training caused us to overlook the opportunities in the business world, which the engineer should take advantage of instead of passing them over to the accountant, the banker or the promoter. A field was afforded for the engineer in promiting legetimate engineering entreprises. The time was ripening for the engineer to take a more prominent part in municipal affairs. City management offered a promising field for the engineer, for which he should prepare himself by a thorough understanding of financing and municipal government.

The chairman referred to the recently adopted policy of the Vancouver Branch to change the Chairman and Vice Chairman each year, to give all members a chance to hold office. Another policy was that of holding luncheon meetings where distinguished engineers could be heard, and which had proven successful. It was learned that both of the representatives of the convention from Vancouver were participating in municipal affairs, one as a councillor and the other as a member of the school board. The Branch had instituted prizes in the science department of the University to stimulate the students to write on engineering subjects.

The chairman called on Secretary Keith for an expression of opinion; the latter stated that during his recent trip West he had quoted salary schedules from an advance copy of the report of The Institute's Committee on Classification and Remuneration. When the official report was received, it was found that the salary schedule had been lowered considerably, and he thought that was a mistake. If we were to set a standard of salaries it should be a very large increase over those at present paid to engineers, to which we could look forward to attaining by all working together for that end. C. S. Walley, A.M.E.I.C. was glad to hear that engineers were taking a greater interest in their own affairs, and considering the opportunities the business world afforded. A better understanding of human nature was needed by the average engineer, who otherwise was well equipped by experience and training for a successful business career. He thought that the Branches should make an effort to have more business men associated with them. H. K. Dutcher, M.E.I.C., of Vancouver, stated that he was able to look at the profession from different viewpoints, having had experience in university work and as a consulting engineer, and now he was inclined to believe that the business side should be more considered. University training had not in the past taken into consideration the economic viewpoint, and he believed that the student should have the business side of engineering strongly impressed upon him during his course. Colonel McPherson expressed slight faith in securing the adoption of salary schedules, and suggested that information be given as to the success of efforts made in the various provinces on this direction. Mr. Cantell mentioned that publicity was one of the fundamental needs of the engineering profession, and offered to give greater publicity to the doings of engineers through the trade and Technical papers which he represented. C. J. Yorath, A.M.E.I.C., city commissioner of Edmonton, apologized for being absent from an earlier session at which he was to speak, and, continuing, endorsed the remarks of City Engineer Craig of Calgary, regarding the engineer presenting his facts to the public in a more intelligible manner. He had adopted a system of using slides and graphs to illustrate his reports and found it very effective. He believed that the tendency of municipalities throughout Canada was towards city managers, the engineer being the logical man to assume that position, and for which he should prepare himself. R. Cunningham outlined the circumstances of his own personal experience in connection with government service covering twelve years, wherein his status had been lowered and he claimed that an injustice had been done, illustrating the necessity of a proper classification with *The Institute* behind it. Professor Matheson endorsed the suggestion made previously, that engineers should be given more opportunity to learn public speaking during their college course. He gave an account of the situation in British Columbia regarding legislation and outlined some of the difficulties experienced before legislation was secured. J. W. Porter, M.E.I.C., endorsed the policy of the Vancouver Branch in enabling as many of the Branch members as possible to hold office, thus encouraging every member to greater activity. A. L. Ford, A.M.E.I.C., of Calgary, deprecated the situation obtaining at various engineering meetings whereby a few of the members are the long speakers. He thought it would be a good idea if more members took part and that at some meetings every member be asked to take part. George D. Mackie, M.E.I.C., city commissioner of Moose Jaw, felt that while it was well to discuss the subject of remuneration, mere discussion got nowhere, and action was needed. He believed that the engineers in Saskatchewan should press for legislation, and continue doing so until it was secured. Mr. Dawson suggested that better results might be obtained if the executives of the various branches would get together occasionally for an exchange of ideas, as such co-operation was desirable. P. J. MacDonald, A.M.E.I.C., of Swift Current, thought that instead of encouraging parents to have their sons take an engineering course, the difficulties encountered should be pointed out, and particularly the small remuneration received. Professor Matheson maintained that many students were taking the engineering course without intending to follow engineering, and expressed his conviction that this training was the very best possible preparation for a business career, over forty per cent of engineering students going into business.

Owing to the lateness of the hour, the chairman found it necessary to close the discussion, regarding the welfare of the engineering profession without any action being taken or any resolutions put forward.

Votes of Thanks

Major Fetherstonhaugh, moved votes of thanks, seconded by Mr. Dawson, all of which were carried with enthusiasm.

"To the University of Saskatchewan and particularly Dr. Ling, acting president, and Professor A. R. Greig, A.M.E.I.C., for their kindness in making it possible to hold the convention in the University buildings, and for affording the splendid facilities for meetings, dining and living quarters which the the university provided.

To Mayor Young for his address of welcome at the initial meeting, and for his courtesy in extending to the members present the privileges of the Saskatoon Club, the Riverside Country Club and the City Golf Club.

To the Saskatchewan Branch of the Engineering Institute of Canada for the excellent arrangements made for such a successful convention, necessitating as it did much hard work on the part of the Branch executive."

A motion to adjourn was made and carried, bringing to a close the formal sessions of one of the most successful conventions yet held.

Sight Seeing

Following luncheon in the main dining hall of University Hall, members and their wives were taken on a sight-seeing tour in automobiles kindly provided by residents of Saskatoon, to the various points of interest throughout the city. As a matter of surprise to all, and a delight to not a few, the first stop was made at the brewery, where light liquid refreshment was available. Visits were made to the university bridge, the electric light and power plant, and the water works and filtration plants in turn, where the many interesting features of these engineering enterprises were pointed out. Following these visits, the party proceeded to the Riverside Country Club, where, as guests of the University, afternoon tea was served. About six o'clock the party dispersed, members leaving for East, West, South and North to their various homes.

Notes

Saskatoon is an ideal convention city.

Living in residence for a few days and enjoying meals in family groups, as were afforded by the facilities of the University, are means of promoting acquaintanceship and friendship that cannot be excelled.

What the ladies lacked in numbers was entirely compensated for by their good looks, graciousness of manner, and the enthusiasm with which they entered into the spirit of the convention. Although the men were too busy to give them much personal attention,the ladies all report having had a good time, one feature of their entertainment being an afternoon tea in the ladies' reception room under the auspices of the women of the University.

Baseball Championship

On the athletic field of the University of Saskatchewan before a vociferous audience the baseball supremacy of the West was staged between the Mudlarks of Manitoba and the Shellfish of Saskatchewan for the engineering baseball championship of the four Western provinces, which resulted in a win for the Shellfish by twelve runs to the Mudlarks six, in a three inning game.

The Mudlarks found the track heavy while the Shellfish crawled around in good style. The latter clawed their opponents rather badly and pinched bases on several occasions, besides crabbing the spavined ones' attempts to score. At the start the Mudlarks considered their opponents a bunch of lobsters, claimed that they were their oyster and they had been stewed, but at the finish they were as silent as a clam, although some of their supporters said it was a shell game.

The umpire was mobbed several times.

The finish was dramatic.

The Mudlarks were at bat with two out and two on bases. At the plate was an old selling plater while his companions in their paddock pawed the ground. He stood with head down, his ears drooping on his neck, legs far apart to withstand the shock of the heaves which threatened to throw him on his haunches. He had two strikes and two balls. He had already been once around the track and to send him again meant the end of his mortal career. At any moment the Society for the Prevention of Cruelty to Animals was likely to step in and stop the game. His life was saved by the umpire calling the third ball a strike. To save his own the umpire fled.

Manitoba

Batting Order	1	2	3	4	5	6	7	8	9	Total Runs
B. S. McKenzie, S.S.	1	0	0	.	.	.	.	.	.	1
Prof. Shipley, L.F.	0	0	.	.	.	.	.	.	.	0
C. S. Walley, 2nd	1	.	0	.	.	.	.	.	.	1
G. L. Guy, C.	0	.	1	.	.	.	.	.	.	1
W. P. Brereton, P.	0	.	1	.	.	.	.	.	.	1
J. W. Porter, R.F.	.	0	0	.	.	.	.	.	.	0
Prof. Moffatt, C.F.	.	1	1	.	.	.	.	.	.	2
N. M. Hall, 1st	.	.	.	.	.	.	.	.	.	0
J. C. Davis, 3rd	.	.	.	.	.	.	.	.	.	0
	2	1	3	.	.	.	.	.	.	6 runs.

Saskatchewan

Batting Order	1	2	3	4	5	6	7	8	9	Total Runs
Prof. Williams, 2nd	1	1	1	.	.	.	.	.	.	3
J. Patton, P.	0	1	1	.	.	.	.	.	.	2
H. Phillips, R.F.	0	.	0	.	.	.	.	.	.	0
C. W. Dill, 1st	.	0	0	.	.	.	.	.	.	1
H. S. Carpenter, L.F.	1	0	1	.	.	.	.	.	.	2
Prof. Hardy, C.	1	0	0	.	.	.	.	.	.	1
W. A. Begg, S.S.	0	.	1	.	.	.	.	.	.	1
D. W. Houston, 3rd	0	.	1	.	.	.	.	.	.	1
R. Loucks, C.F.	0	.	1	.	.	.	.	.	.	1
	4	2	6	.	.	.	.	.	.	12 runs.

Umpire : Fraser S. Keith, Montreal
Scorers : A. A. Young, Manitoba
D. A. R. McCannel, Saskatchewan

Tenth General Professional Meeting

Saskatoon, Sask., August 10th, 11th, 12th, 1921.

Registration

1	Geo. W. Craig	Calgary.
2	B. Stuart McKenzie	Winnipeg.
3	W. M. Scott	Winnipeg
4	Jas. A. Kelso	Edmonton.
5	Arch. Blackie	Winnipeg.
6	J. W. Shiply	Winnipeg.
7	G. M. Williams	Saskatoon.
8	A. S. Dawson	Calgary.
9	Robt. C. Walker	The Pas.
10	W. P. Brereton	Winnipeg.
11	G. D. Archibald	Saskatoon.
12	J. N. de Stein	Regina.
13	G. H. Whyte	Calgary.
14	N. M. Hall	Winnipeg.
15	A. G. Stewart	Edmonton
16	J. C. Davis	Winnipeg.
17	W. N. Smith	Winnipeg.
18	G. W. Porter	Winnipeg.
19	H. K. Dutcher	Vancouver.
20	J. A. Douglas	Winnipeg.
21	C. S. Walley	Winnipeg.
22	E. P. Fetherstonhaugh	Winnipeg.
23	D. A. R. McCannel	Regina.
24	D. T. Townsend	Calgary.
25	P. J. Jennings	Calgary.
26	Arthur L. Ford	Calgary.
27	Thos. McKinley	Winnipeg.
28	Thos. H. Wilson	St. Boniface.
29	M. T. Cantell	Winnipeg.
30	A. H. I. Reilly	Winnipeg
31	H. B. Muckleston	Lethbridge.
32	Geo. A. Walkem	Vancouver.
33	J. G. Legrand	Winnipeg.
34	J. E. Pringle	Regina.
35	Wm. G. Thompson	
36	E. G. Matheson	Vancouver.
37	Fraser S. Keith	Montreal.
38	R. W. Moffatt	Winnipeg.
39	D. W. Houston	Regina.
40	G. G. Fitzgerald	Regina.
41	A. A. Young	Winnipeg.
42	J. N. Finlayson	Winnipeg.
43	J. N. Rocchetti	Winnipeg.
44	Geo. L. Guy	Winnipeg.
45	A. R. Greig	Saskatoon.
46	D. G. Sutherland	Selkirk.
47	B. L. Thorne	Calgary.
48	E. F. Bateman	Saskatoon.
49	A. M. Macgillivray	Saskatoon.
50	W. W. Lambert	Saskatoon.
51	E. A. Hardy	Saskatoon.
52	Samuel R. Parker	Regina.
53	H. B. Sherman	Regina.
54	W. H. Bentley	Regina.
55	W. A. Begg	Regina.
56	H. B. Phillips	Regina.
57	P. C. Perry	Regina.
58	H. L. Carpenter	Regina.
59	Jos. Scholes	Weyburn.
60	R. W. E. Loucks	Regina.
61	E. C. Kehoe	Winnipeg.
62	E. H. Phillips	Saskatoon.
63	Cyril W. Doody	Regina.
64	R. M. Thompson	Saskatoon.
65	E. Brydone-Jack	Victoria.
66	E. E. Brydone-Jack, Jr.	Victoria.
67	F. Brydone-Jack	Victoria.
68	H. R. MacKenzie	Regina.
69	Chas. W. Dill	Regina.
70	Sam. G. Porter	Lethbridge.
71	Duncan C. Gloag	Saskatoon.
72	J. Bruce Parker	Regina.
73	Stuart R. Muirhead	Regina.
74	R. Blackwood	Saskatoon.
75	A. A. Murphy	Saskatoon.
76	C. J. Yorath	Edmonton.
77	W. A. Davidson	Rosedale.
78	A. J. McPherson	Regina.
79	J. McD. Patton	Regina.
80	Donald Maclean	Saskatoon.
81	T. W. Brown	Saskatoon.
82	R. J. MacRae	Saskatoon.
83	T. Thorvaldson	Saskatoon.
84	G. T. K. Verbeke	Saskatoon.
85	Wm. Pearce	Calgary.
86	J. W. Calder	Swift Current
87	P. J. MacDonald	Swift Current.
88	W. D. Elliot	Saskatoon.
89	Geo. D. Mackie	Moose Jaw.
90	J. D. Peters	Moose Jaw.
91	Jimius Jonsson	Prince Albert.
92	J. H. Burd	Winnipeg.
93	H. L. Cavin	
94	J. R. C. Macredie	Moose Jaw.
95	O. T. House	Saskatoon.
96	J. R. Cowley	Saskatoon.
97	H. C. James	Vancouver.
98	M. D. Cadwell	N. Battleford.
99	R. Cunningham	Winnipeg.
100	J. R. Grant	Victoria
101	G. N. Houston	Lethbridge.
102	N. R. Warren	Regina.

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VOL. IV. September 1921 No. 9

Western Professional Meeting

Again the Western members of *The Institute* have demonstrated their organizing ability in planning and carrying out one of the best professional meetings *The Institute* has yet enjoyed which was held at the University of Saskatchewan, Saskatoon, on August 10th, 11th and 12th, under the direct auspices of the Saskatchewan Branch, but sponsored by all Western Branches from Winnipeg to Victoria.

The Institute is proud of its Western members, proud of the work they are doing and the outstanding importance and responsibility attached to many of the positions which they are holding in a creditable manner.

All the sessions and functions of the entire meeting were carried out with great enthusiasm which is a characteristic of the west.

To those who have not had the privilege of attending a Western Professional Meeting it might be pointed out that they have missed some unusually interesting engineering gatherings which have had a character all their own, embodying many desirable features. The programme was broad in its scope and brought out much information relating to the problems concerning the engineers in the West. Papers on highways, irrigation, water supply, the fuel problem, and the disintegration of concrete in alkali soils, were all handled by their authors in a masterly style, while the additional papers gave evidence of further progressiveness. That enginers were becoming alive to the fact that their own affairs deserve attention was evidenced by an entire session being given over to *Institute* matters. A Council meeting was held during the period of the gathering. The social side was not neglected, nor the athletic, to which reference is made in another column.

A number of resolutions were passed.

Following the report of the Committee on Highways appointed at the last Professional Meeting to bring in a report, which report was received at the first session, it was resolved:—

> "That the present committee be continued and enlarged to include three from each province, the additional members to be appointed by the Executive of the various Branches and that this committee as a Committee of *The Institute* assume the responsibility of bringing in a report at the next Professional Meeting".

Owing to the absence of President Fairbairn and the general regret felt on account of his not being able to be present, it was unanimously resolved:—

> "That we, the Western members of *The Engineering Institute*, assembled at the Western Professional Meeting at Saskatoon, regret exceedingly that Mr. Fairbairn is unavoidably absent due to ill health, and in extending wishes sincere for a speedy recovery are looking forward to an opportunity of meeting him at the various branches at an early date."

In the discussion following the papers on irrigation it was pointed out in reference to a treaty between the United States and Canada for the division of water on international streams that owing to the failure of the governments to render a final decision regarding the method of dividing the water supply of the Milk River and the St. Mary River and their tributaries, irrigation projects affected by these streams in Southern Alberta had been stopped. It was therefore unanimously resolved:—

> "That *The Engineering Institute of Canada*, assembled in Convention at Saskatoon, shall urge upon the Premier of Canada and the Minister of

the Interior to take every means in their power to effect an early settlement of the terms of the International Waterways Treaty in order that this development may go forward."

Regarding the North Saskatchewan irrigation project which has been fathered by William Pearce, M.E.I.C., it was unanimously resolved:—

> "That this convention of *The Engineering Institute of Canada* should urge upon the Minister of the Interior and the Prime Minister of the Dominion that all steps should be taken to carry on the necessary preliminary investigation in connection with the North Saskatchewan Irrigation scheme, in order that the information should be available at an early date as to the feasibility and advisability of the scheme."

The following votes of thanks were passed:—

To the University of Saskatchewan and particularly to Dr. Ling, acting president, and Professor A. R. Greig, A.M.E.I.C., for their kindness in making it possible to hold the convention in the University buildings, and for affording the splendid facilities for meetings, dining and living quarters which the university afforded.

To Mayor Young for his address of welcome at the initial meeting, and for his courtesy in extending to the members present the privileges of the Saskatoon Club, the Riverside Country Club and the City Golf Club.

To the Saskatchewan Branch of *The Engineering Institute of Canada* for the excellent arrangements made for such a successful convention, necessitating as it did much hard work on the part of the Branch executive.

Six Western cities were officially represented at the meeting, Weyburn, Saskatoon, Regina, Edmonton, St. Boniface and Winnipeg.

Canadian Engineering Standards Association Sub-Committee on Watt-hour Meters

A meeting of this sub-committee was held on Thursday, the 25th inst., at the Engineer's Club, Toronto, Professor L. W. Gill, M.E.I.C., in the chair.

Considerable progress was made in preparing a revised draft of the proposed "Standard Requirements for Watt-hour Meters," the committee taking up first various points connected with watt-hour meters for alternating current; direct current meters being left for later consideration.

Fifteen members were present, nominated by the meter manufacturers, the Canadian Electrical Association, the large power companies, the Hydro-Electric Commission of Ontario, the Electrical Supply Manufacturers' Association, and the Dominion Government Electrical Inspection Department.

It is expected that substantial agreement will be reached on such points as standard methods of testing for accuracy, uniform methods of marking, rating, and connection, and standard requirements for potential and current transformers and other accessories, and that it will be found possible to effect economy by limiting the number of sizes and types of watt-hour meter to be recognized as standard for regular production.

Expression of Appreciation

In the July issue of *The Journal* reference was made to a proposed dinner to be given in honour of the president and board of direction of the American Railway Engineering Association by the President and Council of *The Institute.* Following extending the facilities of Headquarters for the meeting of the board of direction of the A.R.E.A. and the dinner given in their honour the letter received from President Downs by President Fairbairn is of interest:

American Railway Engineering Association

Chicago, August 27, 1921

J. M. R. Fairbairn, Esq., M E.I.C.
President, The Engineering Institute of Canada,
Montreal, Canada.

My dear Mr. Fairbairn:—

It affords me very great pleasure to convey to yourself and to the officers and members of the Council of The Engineering Institute, on behalf of the Board of Direction of the American Railway Engineering Association, our hearty thanks and appreciation of the many courtesies extended to us on the occasion of our meeting in Montreal on July the thirteenth.

The spirit of good-fellowship prevailing at the dinner tendered the visiting members of the Board by the Council of The Engineering Institute at the University Club on the evening of the thirteenth was especially gratifying.

This enjoyable function will tend to still further cement the bond of friendship which has always existed between engineers of the two countries.

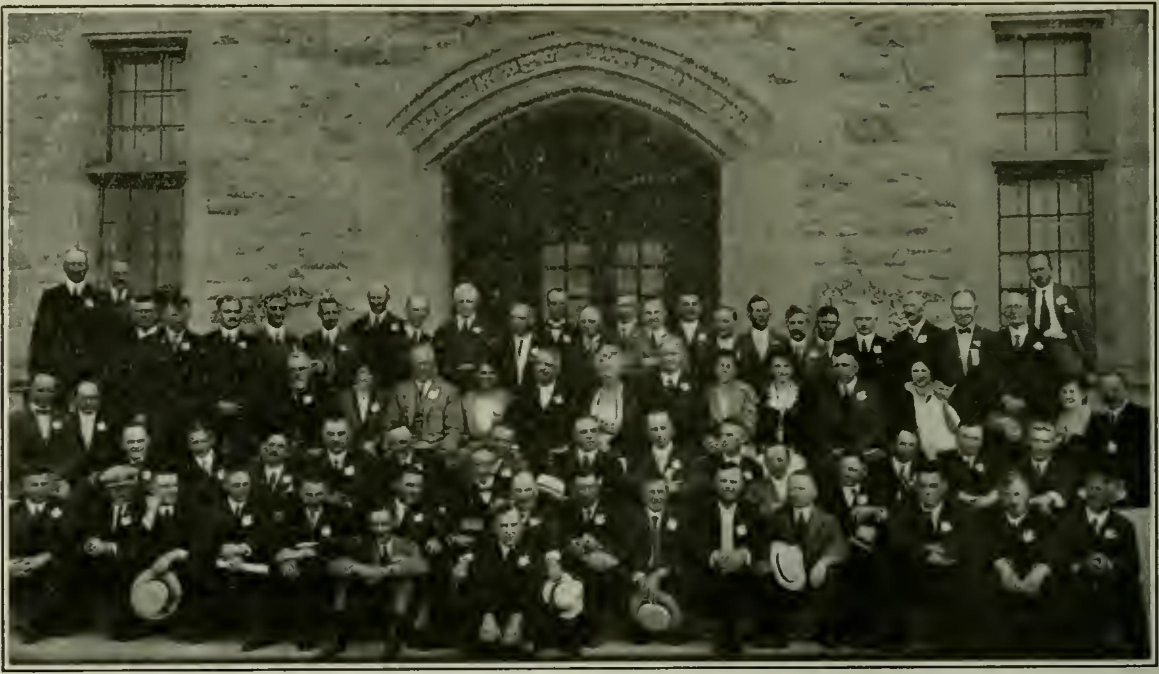
With kind personal regards,
Cordially yours,
L. A. Downs,
President.

McGill Re-union

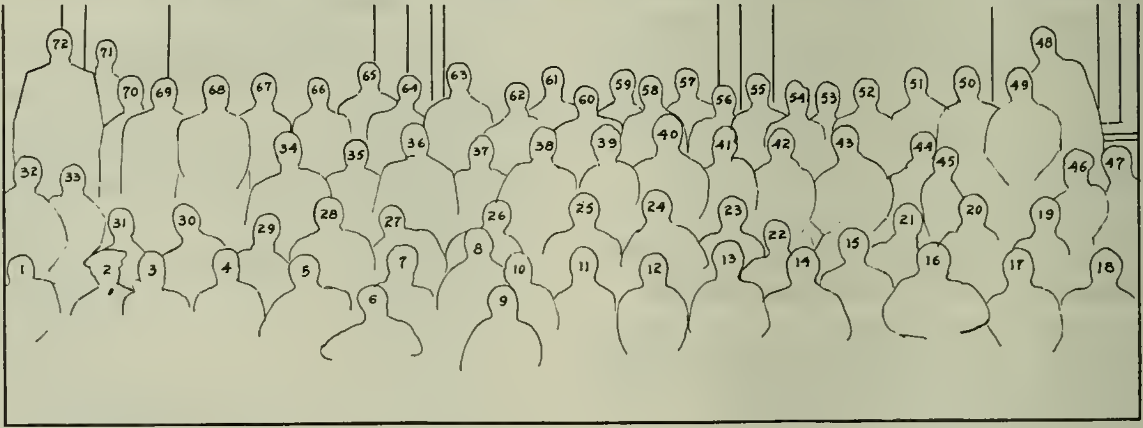
From October twelfth to sixteenth the centenary of Old McGill will be celebrated at Montreal by a re-union of all graduates and former under-graduates that promises to be historic.

Many members of *The Institute* are graduates of McGill and it is hoped that all who come to Montreal for the re-union will make a point of calling at headquarters and of making use of the facilities afforded by the Institute's building. The headquarters' staff will carefully look after all letters and telegrams addressed to *The Institute* and members are expected to take advantage of the facilities offered, using 176 Mansfield Street as a mailing address as well as a convenient meeting or lounging spot. Stenographic facilities will also be available for any who desire.

The Secretary expects to be at home during the week of the re-union and hopes that many members will pay him a visit.



Tenth General Professional Meeting, Saskatoon, August 10th. 11th. 12th. 1921.



No.	Name	Place
1	A. H. O'Reilly	Winnipeg
2	T. H. Kirby	Winnipeg.
3	J. N. Finlayson	Winnipeg.
4	J. Jonsson	Prince Albert
5	J. E. Pringle	Regina.
6	E.P.Fetherstonhaugh	Winnipeg.
7	H. K. Dutcher	Vancouver.
8	P. J. Jennings	Calgary.
9	M. A. Lyons	Winnipeg.
10	A. R. Greig	Saskatoon.
11	J. Patton	Regina.
12	Dr. J. W. Shipley	Winnipeg.
13	H. Phillips	Regina.
14	Fraser S. Keith	Montreal
15	R. Blackwood	Saskatoon.
16	C. S. Walley	Winnipeg.
17	Dr. R. C. Wallace	Winnipeg.
18	J. H. Burd	Winnipeg.
19	H. S. Carpenter	Regina.
20	H. R. McKemzie	Regina.
21	J. N. De Stein	Regina.
22	J. Scholes	Weyburn.
23	G. G. Fitzgerald	Regina.
24	R. W. E. Loucks	Regina.
25	C. W. Dill	Regina.
26	A. L. Ford	Calgary.
27	A. S. Dawson	Calgary
28	J. G. Legrand	Winnipeg.
29	W. N. Smith	Winnipeg
30	G. L. Guy	Winnipeg.
31	J. C. Davis	Winnipeg
32	D. G. Sutherland	Selkirk.
33	C. W. Doody	Regina
34	Wm. Pearce	Calgary.
35	Mrs. C. S. Walley	Winnipeg.
36	G. A. Walkem	Vancouver.
37	Mrs. W. P. Brereton	Winnipeg.
38	Geo. W. Craig	Calgary.
39	Mrs. Zaida F. Dill	Winnipeg.
40	E. G. Matheson	Vancouver.
41	Mrs. P. C. Perry	Regina.
42	Mrs. H. Phillips	Regina.
43	J. R. C. Macredie	Moose Jaw.
44	Mrs. J. W. Calder	Swift Current.
45	Master J. W. Calder	Swift Current.
46	Mrs. D. A. R. McCannell	Regina.
47	J. W. Calder	Swift Current.
48	H. McL. Weis	Saskatoon
49	W. A. Begg	Regina.
50	D. A. R. McCannell	Regina.
51	O. P. House	Saskatoon.
52	J. A. Douglas	Winnipeg.
53	G. M. Williams	Saskatoon.
54	M. T. Cantell	Winnipeg.
55	P. C. Perry	Regina.
56	R. W. Moffatt	Winnipeg.
57	A. A. Young	Winnipeg.
58	T. H. Wilson	St. Boniface.
59	A. Blackie	Winnipeg.
60	B. L. Thorne	Calgary.
61	H. L. Cairns	Shannavon.
62	W. P. Brereton	Winnipeg.
63	B. S. McKenzie	Winnipeg.
64	W. M. Scott	Winnipeg.
65	G. W. Whyte	Calgary.
66	A. G. Stewart	Edmonton.
67	N. M. Hall	Winnipeg.
68	J. Rocchetti	Winnipeg.
69	P. J. McDonald	Swift Current.
70	M. Verbeke	Saskatoon.
71	R. M. Thompson	Saskatoon.
72	Col. A. J. McPherson	Regina.

Elections and Transfers

On August 12th, 1921, the following admissions and transfers were effected:-

Members

Harold A. Bodwell, struct'l. engr., Toronto Hydro-Electric, Toronto; Pierre Michel Helbronner, arch't. & engr. with T. Pringle & Sons Ltd., Montreal; Walter Lambert, consltg. naval arch't., Montreal, Que.; John Leiper Lang, B.A.Sc. (Univ. of Toronto), D.L.S., O.L.S. member of firm, Lang & Ross, Sault Ste. Marie, Ont.; Louis de-Berniere McCrady, B.S.(C.E.) chief engr., Canadian Explosives Ltd., Montreal, Que.; Joseph Pettus Newell, consltg. engr., Dept. of Rlys. & Canals, G. T. R. Arbitration, Montreal, Que.; Henry Bigelow Oatley, B.S. (Vermont Univ.), Vice-Pres., Superheater Co., New York, N. Y.; Geoffrey Gream Ommanney, investigation engr., Dept. Colonization & Development, C.P.R., Montreal, Que.; Bertwell C. Root, mgr., pulp & paper mill divn., Hydraulic Machinery Co. Ltd., Montreal Que.; Stuart Southmayd Scovil, B.Sc. (Honours), (Queen's Univ.), engr. to Lake of the Woods Control Board and senier asst. engr., Dominion Water Power Branch, Ottawa, Ont.; Franklin Smallwood, Chief engr., Algoma Steel Corpn., Sault Ste. Marie, Ont.; Arthur Albert Smith, divn'l engr. in charge of constrn. prov. highway, East of Toronto, Toronto, Ont.; Ernest Walter Stedman, Assoc., Royal College of Science, London, England, Director, Technical Section, Air Board, Ottawa, Ont.; George William Thompson, gen. mgr., City of Westmount and supt. of Westmount Light & Power Dept., Westmount Que.;

Associate Members.

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(McGill Univ.) consltg. engr., mech., elect'l. and marine work, Montreal, Que.; Arthur Frederick Galea, (Malta Univ.) struct'l steel designer, H.E.P.C. of Ontario, Toronto, Ont.; George Goodwin, (Queen's Univ.), hydrometric work, D.P.W., Ottawa, Ont.; John Bernard Gough, chief dftsman., factory bldgs. and mech. equip. Laurentide Co., Grand Mere, Que.; Frank Charles Graham, asst. city engr., Port Arthur, Ont.; Francis William Gray, (Univ. of Sheffield), Editor, "Canadian Mining Journal and Iron & Steel of Canada", Ste Anne de Bellevue, Que.; Kennington Henry Scott Hague, B.Sc. (E.E.), (McGill Univ.), elect'l engr., A. A. Giddings & Co., Montreal, Que.; John Francis Harries, B.S.A. (Univ. of Tor.), chief asst. to chief engr., Canada Starch Co. Ltd., Montreal, Que.; William Rooker Hughson, B.Sc. (Queen's Univ.), computer for the H.E.P.C. St.Lawrence River investigations, Kingston, Ont.; Robert Edwards Jamieson, B.Sc. (Civil), (McGill Univ.), lecturer in maths. and civil engr'g., McGill Univ., Montreal, Que.; Joseph Alfred Lacouture, Montreal Water Board, Steel Struct'l Works, Montreal, Que.; Theo Lanctot, C.E. (Ecole Poly., Laval), city engr., Hull, Que.; William Latta, checker, Dominion Bridge Co., Lachine Que.; William Cooper Lumbers, (S.P.S. Univ. of Tor.), asst. engr., Barber, Wynne-Roberts & Seymour, Toronto, Ont.; William Alton MacLachlan, B.A.Sc. (Univ. of Tor.), chief dftsman., Highways Dfting. Dept., Toronto, Ont.; Irvine Meredith Marshall, B.Sc. (Queen's Univ.), engr., Iron Mountain Mining Co., Iron Mountain, Miss.; John Lawrence Tassie Martin, B.Sc. (M.E.), (McGill Univ.), asst. engr., Shawinigan Engineering Co., Montreal, Que.; Louis Edwin McCoy, B.S. in E.E. (Univ. of Oregon), engr. dftsman., Shawinigan Engineering Co., Montreal, Que.; James Alexander McCrory, B.S. (Penna. State College), office engr., Shawinigan Engineering Co., Montreal, Que.; Cecil Burdette McDougald, res.engr., N.S. Wood Pulp & Paper Co., Ltd., Caledonia, N. S.; Thomas McGuinness, asst. supt., City of Regina Street Railway Dept., Regina, Sask.; Colin Campbell McLennan, (R. M. C. Kingston), hydrometric engr. ,H.E.P.C. of Ontario, Toronto, Ont.; Eben Carlyle Miller, engr. in charge of Toronto office, T. Pringle & Sons, Engrs., Toronto, Ont.; James Thomas Mogan, B.A.Sc. (Univ. of Tor.) field engr. in charge of constn., Russel & Roddick, Marine Contractors, Toronto Harbor Improvements, Toronto, Ont.; Thomas Albert Sprake Munford, instr'man., C. P. R. Toronto, Ont.; Brete Cassins Nowlan, B.Sc. (E.E.), (Iowa State College), asst. telephone sales mgr., Northern Electric Co. Ltd., Montreal, Que.; Reginald I. Olmsted, res. supt., engr'g branch, D.S.C.R., Calgary, Alta.; Gurdon Hoard Osborne, B.S. (Mich. Agric. College), mgr. of sales engr'g., The Canadian Sirocco Co Ltd., Montreal, Que.; Alexander Ernest Patterson, B.Sc. (McGill Univ.), in charge of mtce., structures and bldgs., M. & S. C. Rly., Longueuil, Que.; Frederick Robert Phillips, (Hons. Diploma), City & Guilds Inst., London, chief engr. for L. E. Dowling, constrn. engr., Toronto, Ont.; Ernest Pickles, mech. engr., hydraulic dept., H.E.P.C. of Ontario,Toronto, Ont.; Thomas Henry Porter, city engr., Portage la Prairie, Man.; Herbert Raine, (S. P. S. Univ. of Tor.), engr.,Peckover's Ltd., Toronto, Ont.; Charles Raley, office engr.,D.N.R., C.P.R., Lethbridge, Alta.; Gilbert Rayner, (Liverpool Coll.), Grimsby, Ont.; Alexander Roberts, Jr., designer & dftsman., Wm. Hamilton Co. Ltd., Peterborough, Ont.; Tom Robertson, in charge of work, struct'l engr'g dept., Dominion Bridge Co., Toronto, Ont.; George Gates Robinson, C.E. (Cornell Univ.), sales engr., Jno. E. Russell Co., and engr., Independent Concrete Pipe Co., Ltd., Toronto, Ont.; John Robert Rostron, asst. engr. on special works to H. A. Brazier, city engr., London, Ont.; George Graham Routledge, supt. of Water District Section of Works Dept., City of Toronto,; Frederick George Rutley, B.A.Sc. (Univ. of Tor.), res. engr., The Foundation Co., Ltd., Fairville, N. B.; Albert St. Lawrence Sandall, (N. S. Tech. Coll.), engr'g inspection at Northern Electric Co., Montreal, Que.; Charles James Lacy Sanderson, in charge of constrn. of bridges under W. H. Tye, asst. engr., C. P. R., Acme, Alta.; John William Sanger, supt., Power House, City Light & Power Dept., Winnipeg; Beresford Henry Segre, B.A.Sc. (Univ. of Tor.), D.L.S., Chief of party, Dom. Land Surveys, Toronto, Ont.; Frederick Robert Shenstone, B.E. (Univ. of Ireland), Bamfield, B.C.; Edward William Skinner, (Queen's Univ.), asst., dept. of drawing, Faculty of Applied Science, Queen's Univ., Kingston,; John Alfred Spreckley, Water Administration Engr., Dept. of the Interior, Calgary, Alta.; John Stephenson, designer N.S. steel & Coal Co., Sydney Mines, N.S.; John Kobertson Stewart, town engr., Reufrew, Ont.; Charles Henry Taggart, D.L.S., in charge of parties making special surveys etc., under Surveyor General, Kamloops, B. C.; George Harry Thompson, B.Sc. (E.E.), (McGill Univ.), sales engr., Canadian Westinghouse Co., Calgary, Alta.; George Alexander Tobias, B.Sc. (Honours), (Queen's Univ.), design of temporary structures and constrn. of plant equipment, H.E.P.C. of Ontario, Niagara Falls, Ont.; Ernest Henry Tredcroft, acting divn. engr., Dom. Water Power Branch, Dept. of the Interior, Kamloops, B. C.; Alfred Trott, Levy Electric Co., Winnipeg, Man.; Melville Ralph Walton, B.S. (George Washington Univ.) engr., Russell Constrn. Ltd., Toronto, Ont.; George Percival Wilbur, chief dftsman., Dominion Bridge Co., Toronto Co.; Arthur Edward Woollam, squad boss, engr'g dept., Riordon Co. Ltd., Mattawa, Ont.; Percy Frederick Yarwood, (Univ. of Alberta), Edmonton, Alta.

Associate

Ernest Edward Poole, pres. and mgr., Poole Constrn. Co. Ltd., Regina, Sask.;

Juniors

James Stewart Arbuckle, B.Sc. (E.E.), (McGill Univ.), Pictou, N.S.; Joseph Arthur Bigras, (Ecole Poly., Laval), engr'g work for J. Duchastel, City Hall, Outremont, Montreal, Que.; Louis Cailloux, gen. mech. engr'g for A. Lamontagne, C.E., Montreal, Que.; Joseph E. Carmichael, chief asst. to H. W. Patterson, Windsor, Ont.; Joseph Paul Chapleau, C.E. (Ecole Poly. Laval), engr'g staff, Price Bros. Co. Ltd., Chutes aux Galets, Que.; Norman Melville Cooke, B.Sc. (Queen's Univ.), Kingston, Ont.; Harold Franklin Coon, B.A.Sc. (Univ. of Tor.), road engr'g., Barrett Mfg. Co. Ltd., Toronto, Ont.; Edward Mansel Carey Goodwin, (Univ. of Tor.), instr'man Riordon Co. Ltd., Temiskaming, Que.; Charles Duncan Grigg, instr'man., with H. W. Patterson, Windsor, Ont.; William Sidney Kidd, B.A.Sc. (Honours), (Univ. of Tor.) dftsman & designer, Riordon Co. Ltd., Mattawa, Ont.; Arthur Rolland Lee, instr'man, hydrographic survey, Dept. of the Naval Service, Ottawa; Frederick Gerald MacLellan, transitman, divn. engr's office, C.N.R., Moncton, N.B.; John Alphonse Marck, civil engr., Steel Co. of Canada, Hamilton, Ont.; Frederick Leonard Mayes, (Univ. of N.B.), gen. constrn. & surveying with G. G. Murdoch, St. John, N.B.; William John Miller, hydro. recorder, hydrographic survey, Ottawa, Ont.; Victor Leo Mueller, checking & designing struct'l work, Dominion Bridge Co., Toronto, Ont.; Ralph Lee A. Strathy, B.Sc. (E.E.), (McGill Univ.) ,testing dept., C.G.E.Co., Peterborough, Ont.; Trevor Creighton Thompson, B.Sc. (McGill Univ.), Montreal, Que.; Alfred Claud Turtle, electr'l engr., G.T.P.Ry., Winnipeg Man.; William E. Walsh, Jr., chief dftsman, R. McDougall Co. Ltd., Galt, Ont.; William Smith Wilson, tech. engr., Dominion Iron & Steel Co., Sydney, N.S.;

Transferred from the class of Associate Member to that of Member

Alexander Lorraine Carruthers, (Univ. of Tor.), dist. engr., D.P.W. Prov. of B.C., Prince Rupert, B.C.; Hamilton Talbot Crosbie, town engr., Yorkton, Sask.; Eben Nasmith Harvie, chief engr., Cambridge Coprolite Workings, Trumpington, Cambridge, England; LLewellyn C. Jacobs, B.A. (Univ. of Man.), gen supt. of constn.,The Foundation Co., Ltd., Montreal, Que.; Joseph Baerman Strauss, C.E. (Univ. of Cincinnati), President and chief engr., Strauss Bascule Bridge Co. and Strauss Yielding Barrier Co., Chicago, Ill.; William Grant Tyrrell, (R. M. C. Kingston), Lt. Col., Royal Engineers, Fermoy, Ireland.

Transferred from the class of Junior to that of Associate Member

Clinton Lowell Dodge, B.Sc. (Colo. State College), res. engr., Lethbridge Northern Irrigation District, Lethbridge, Alta.; George Vibert Douglas, B.Sc. (McGill Univ.), Westmount, Que.; Cecil Herbert Gunn, (Univ. of Man.), field engr., Manitoba Power Commission, Winnipeg; Leopold Laferme, asst. engr., G.T.R. Valuation, Montreal, Que.; Harry W. Patterson, private practice and engr. for Walkerville & Ford City, Windsor, Ont.; Charles George Read, (London Univ.), res. engr. on design & constrn., Prov. Highways Board of Nova Scotia, Halifax, N.S.

Transferred from the class of Student to that of Associate Member

Charles Stanley Boyd, B.Sc. (Queen's Univ.), dfting office, Canadian Des Moines Steel Co., Chatham, Ont.; Garnet Rankin, B.A.Sc. (honours), (Univ. of Tor.), engr., city architect's office, Toronto, Ont.; Roy Cecil Ward, B.A.Sc. (Univ. of Tor.), estimating & designing, Toronto Iron Works, Toronto, Ont.;

Transferred from the class of Student to that of Junior

Jules Comeau, C.E. (Laval Univ.), asst.engr., Public Works & Labor, Bridge Branch, Quebec Govt., Montreal, Que.; Frank Melbourne Mooney, Jr., B.Sc. (Mining), (McGill Univ.), timber tester, Forest Products Laboratories, Montreal, Que.

CORRESPONDENCE

St. Lawrence Navigation and Power Investigation

Ottawa, Ont.

Editor, *Journal*,—

Dear Sir:

In the matter of the St. Lawrence Navigation and Power Investigation, the International Joint Commission has decided that all interested parties are to be given thirty days from August 20th for the purpose of studying the report and plans of the engineers appointed by the two governments, and ten days additional to submit in writing to the Commission any comments they may wish to make upon the plans of the Engineering Board,or any suggestions they may desire to offer as to alternative plans. Copies of the report and plans of the engineers may be consulted in the offices of the Commission at Ottawa and Washington and also in the United States Lakes Survey Office at Detroit.

Yours very truly,

LAWRENCE J. BURPEE, M.E.I.C., *Secretary.*

Ottawa, August 20th, 1921.

Dominion Government and Technical Education

August 23, 1921

Editor, *Journal*:—

Dear Sir:

In reply to your request for a statement with reference to my resignation as Director of Technical Education, I submit the following:—

The conditions which gave rise to the resignation are, (1) The remuneration is not commensurate with the duties and responsibilities of the position, and (2) considerable difference of opinion has arisen between the government and the writer with respect to the policies to be followed in "promoting" technical education in Canada.

With regard to remuneration, attention is drawn to the fact that the salary at present paid is lower than that paid to several of the provincial directors of technical education, the difference amounting in one case to $1800. The status of the position is thus fixed at a lower level than that of the provincial officials referred to, yet the federal director— if he is to function as such,—must confer and co-operate with, and if he is to "promote" technical education he must be qualified to give suggestions and advice to the officials referred to. If the federal government does not give due recognition to its own official, it can scarcely be expected that the provincial governments will look upon the federal official as being capable of giving advice to their own officials. In his dealings with the provinces the federal director is thus forced to work under a handicap, quite apart from the question of personal remuneration.

Certain details in connection with the above may be of interest to the public. When the writer was appointed to the position in November 1919, no mention was made of salary schedule. Shortly afterwards, however, he learned that a schedule had been fixed, and—much to his surprise—the minimum of the schedule was lower than the initial salary paid. This was taken to indicate that there was some doubt as to what the salary should be. When sufficient information was obtained to establish the market value of a man capable of filling the post, an appeal was made to the Civil Service Commission. The case was considered by the Board of Hearing. Information was submitted showing the salaries paid to provincial directors of technical education. It was pointed out that if the federal director was to cooperate with, and give suggestions and advice to provincial officers he should be placed at least on an equal basis with respect to salary, so that he would not be handicapped in his work. It was also pointed out that the federal government could not retain for any length of time the services of a competent man at a salary much lower than that which he could command in the provincial field. In this connection the Board were informed that the writer had several opportunities to take up provincial work at a higher salary. Yet, after considering the case very fully, the Board "is of the opinion that the salary at present attached to the position, namely $3900 to $4800, is comparable with the compensation attached to other highly technical positions in the service, and should therefore stand." In making this recommendation the Board no doubt did what to them appeared fair and in the best interests of the service. The writer therefore has no personal fault to find with the Board nor with the Commission in their acceptance of the recommendation. Decided objection, however, is taken to the system which enables the Commission to reach such a decision. Referring to the recommendation of the Board it is noted that the opinion as to the adequacy of the salary was reached by making comparison with other "highly technical positions". As far as the writer is aware there is no other position in the civil service which is to any extent similar to the one in question. But there are several others with similar official designation, i.e., there are several "directors". And so the button is pressed, the crank is turned and the decision rolls out as to the salary the Director of Technical Education should receive. Duties and responsibilities are of no account. It would be as reasonable for a horseman to fix the value of one class of thoroughbred horses on the basis of the selling price of other classes of thoroughbreds.

In attacking the system of the C.S.C. the writer is well aware that it is not all of their own making. A part of this system has been forced on them by the government and a part is traditional. The combined result appears to be that the Commission have become entangled in the system like a fly in a spider's web, and like the fly they will probably die trying to extricate themselves. Recent events clearly indicate that this organization will fail to function on account of internal difficulties before it will collapse under attacks from without. The situation inside may be well understood by anyone who has been lost in a London fog.

With reference to the question of government policy relating to the promotion of technical education, the writer does not wish to make any detailed public statement at the present time. The government are responsible to the people and obviously must fix the policy for which they alone are responsible. On the other hand when a government official whose duties are "highly technical" finds that his opinions regarding policy and methods are at considerable variance with those policies which he has to carry out, his usefulness is considerably impaired. If such conditions are likely to continue his obvious course is to resign.

In conclusion it may be stated that personal relations with the Minister and all the officials of the Department of Labour have been very cordial and harmonious, and it is with deep regret that connections with the department are severed. Above all the writer regrets that he will have no further voice in shaping this great educational movement which is now well under way, and which in his opinion is the most important and far-reaching problem confronting the people of Canada to-day.

The above statement has been prompted entirely by the interest which the writer, as a citizen, has in the promotion of vocational education from a national viewpoint.

Yours truly,

L. W. Gill, M.E.I.C.

EMPLOYMENT BUREAU

To make this department more valuable it is proposed that in future advertisements of situations vacant should state salary, and give details of requirements.

Situations Vacant

Professor of Electrical Engineering

Professor of Electrical Engineering in College in Eastern Canada, duties to commence October 1st, 1921, Box 203.

Situations Wanted

Student Member

Graduate civil engineer available for engagement with engineer or contractor. Six years experience in general construction work inside or outside. Best references. Box 82-P.

Civil Engineer

Student member, desires work in engineering line. Two years McGill University (Science), one year general transit work and drafting. Can commence work at once. References and further particulars on request. Box 83-P.

PERSONALS

J. A. Bernier, A.M.E.I.C., has been appointed city engineer of the Corporation of Shawinigan Falls.

*

Capt. H. S. Cameron, A.M.E.I.C., is now with the Good Roads Board, Manitoba, resident at Morris, Man.

*

Capt. W. A Ervine-Grim, M.E.I.C. is returning to Canada from Mazatlan, Mexico, and expects to take up residence in Vancouver, B.C.

*

G. B. Anderson, M.E.I.C., has been transferred by the Department of Public Works from Ottawa to Sault Ste. Marie, Ont.

*

Capt. C.K. Brown, M.C., A.M.E.I.C., late of Winnipeg is now with the Provincial Department of Public Highways, Regina, Alta.

*

Capt. E. V. Deveral, M.C., A.M.E.I.C., has accepted an appointment on the staff of Messrs. Barber, Wynne-Roberts, and Seymour, consulting engineers, Toronto.

*

P. E. Doncaster, M.E.I.C., has been transferred by the Department of Public Works from New Westminster, B.C. to Nelson, B.C.

*

C. E. Hogarth, A.M.E.I.C., is at present sales engineer with the Refinite Company of Canada, covering the Eastern territory.

*

H. J. DeSavigny, A.M.E.I.C., has been transferred by the Department of Highways from Weyburn, Sask., to Swift Current. Sask.

*

L. J. M. Howard, A.M.E.I.C., has been appointed general manager of the Benjamin Wheel Company, Limited, Yarker, Ont.

A. Malloch S.E.I.C., is now employed in the draughting force of the Canadian Pacific Railway at Windsor St. station, Montreal.

*

John P. Watson, A.M.E.I.C., has left the Wayagamack Pulp and Paper Company, and is now engaged with the Motive Department of the Canadian Pacific Railway Montreal.

*

John S. Bates, A.M.E.I.C., formerly chemical engineer, Price Bros., Kenogami, Que., is now with the Bathurst Company, Bathurst, N.B., employed in connection with the pulp mills of the company.

*

F. X. Amoss A.M.E.I.C., until recently division eng'r., E.N.R., Fort Williams, Ont. is now with the Dominion Equipment and Supply Co. Limited, Winnipeg, Manitoba.

*

D. O. Lewis, M.E.I.C., has been appointed a director of the Engineering Corporation Ltd., Rogers Building, Vancouver, B.C., engineers and contractors for plant systems and equipment.

*

G. A. Bennet, Jr.E.I.C., who was appointed by the John S. Metcalf Company as engineer on the reconstruction of the ten million bushel elevator forty per cent destroyed by a grain dust explosion last March is now resident in Chicago and actively engaged in connection with the erection of the new elevator.

*

G. C. Piché, A.M.E.I.C., chief forest engineer of the Province of Quebec, addressed the Rotary Club of Quebec on August fourteenth on the subject of forestry and its aims. Mr. Piché emphasized the necessity for all citizens, as well as for the Government, to take steps to safeguard the forests in every possible way.

*

A. E. Doucet, M.E.I.C., director of public works, City of Montreal, recommended to the Administrative Commission the acceptance of the tender of the Atlas Construction Company for the new electric pump station at Point St. Charles. The contract was awarded to the Atlas Construction Company for $498,800. C. M. Morssen, M.E.I.C., is president, and S. W. Dawes, M.E.I.C., vice-president and manager of the Atlas Construction Company

*

Major-General G. B. Hughes, C.B., C.M.G., D.S.O., F.R.G.S., M.E.I.C., will have the sympathy of his fellow members in the death of his father, Sir Sam Hughes, which occurred at his home at Lindsay on August twenty-fourth. Major-General Hughes was called to Canada last winter on account of his father's condition but was in England at the time of his father's death, having been notified by cable a day or two previously that the end was near.

J. M. Hector Cimon, A.M.E.I.C., recently appointed Secretary Treasurer of the Quebec Branch, was born in April 1893 at Rivière du Loup. He was educated at Commercial Academy, Quebec Seminary, Laval University of Quebec and Ecole Polytechnique of Montreal, taking the following degrees, B.A. Laval, B.A.Sc. and C.E. Mr. Cimon's engineering experience has been since his graduation with Price Brothers and Company Limited, for which company Mr. Cimon is office engineer.

J. M. HECTOR CIMON, A.M.E.I.C.

BRANCH NEWS

Moncton Branch

M. J. Murphy, A.M.E.I.C., Secretary-Treasurer

W. A. Duff, M.E.I.C., engineer of standards, Canadian National Railways, Toronto, and past Chairman of Moncton Branch, was a recent visitor to Moncton, and was warmly welcomed by his many friends, here.

C. B. Brown, M.E.I.C., engineering assistant, Canadian National Railways, Toronto, was also a recent visitor to Moncton, and his many friends were delighted to see him looking so well after his recent illness.

An extension of the yard is being made along the St. John subdivision from the West end of the present yard to what is locally known as the Salisbury Road Crossing, mile 1.8. The main line is being diverted from its old position to the North side of the yard, almost parallel to the Salisbury Road. The yard and engine facilities will all be located on the South side of the new main line and between that and the Petitcodiac River. It is proposed this year to lay about five miles of new track in the yard and the layout is such that additions may be made as conditions require same. This work involves a large amount of grading,—part of which was done last year,—and on which a steam shovel outfit will be engaged, practically, during the whole of the present summer season.

The buildings to be constructed consist of: a 40-stall enginehouse—33 stalls of which are 100 ft. long and 7 stalls 120 ft. long, the latter of which are equipped with drop pits for changing wheels, and other appliances for making heavy running repairs to locomotives, a machine shop 85′ x 50′ located back of the long stalls in the enginehouse, a power-house 80′ x 45′ which contains boilers, air compressor, and one of the fans for heating the roundhouse, stores and office building 100′ x 30′; this building contains office for locomotive and machine shop staff; lockers, washroom, etc. for enginemen, and stores for shop and locomotive supplies, two double track deep ash pits, steel water tank, 150,000 gallons capacity with complete system of standpipes, etc., mechanical coaling plant with storage capacity for 350 tons of coal.

All buildings, with the exception of the water tank and coaling plant have brick walls and wooden frames on concrete foundations, the roofs to be of tar and gravel or other asphalt roofing. A mechanical hot air heating system is being installed in the power-house, enginehouse, and machine shop. All buildings will be equipped in a thoroughly up to date manner for the efficient handling of locomotives.

The work of construction was commenced in May and it is expected the buildings will be occupied during the coming winter.

The design and construction of the buildings is being carried on under the supervision of A. F. Stewart M.E.I.C., chief engineer Can. Nat. Rys., H. J. Crudge, A.M.E.I.C., assistant engineer of buildings, Can. Nat. Rys. and R. G. Gage, M.E.I.C., signal and electrical engineer, Can. Nat. Rys. have had charge of the design of the buildings and mechanical equipment, respectively. The work in the field is under the direct supervision of S. B. Wass, A.M.E.I.C., construction engineer, Can. Nat. Rys. with H. L. Currie, A.M.E.I.C., and E. R. Evans, A.M.E.I.C., assistant engineer, Can. Nat. Rys. in charge of the buildings and grading work respectively.

St. John Branch

Harry F. Bennett, A.M.E.I.C., Secretary-treasurer

The St. John Branch lost an Honorary Member in the death on July 30th, of Senator James Domville, at Rothesay, N.B. at the age of 79.

The Honorable James Domville, F.R.C.I., F.R.G.S., honorary colonel of the 8th. Princess Louise -Hussars and a member of the Canadian Senate for eighteen years was born in Belize, Honduras, in 1842,the son of the late Lt. Gen. James W. Domville of the Royal Artillery. He was educated in England and came to Canada in 1860, where he later engaged in the manufacture of iron and steel products. He was interested in the gold mining of the Yukon and in later years was a pioneer in promoting the development of the oil shales in Albert County, New Brunswick, and lived to see some of his dreams bear fruit.

Col. Domville has always taken an active interest in military affairs, and by his enthusiasm had developed cavalry training to high standard in the Maritime Provinces. He early became interested in politics being elected to the House of Commons in 1873 and later in 1896. He was called to the Senate in 1903.

Senator Domville was elected an Honorary Member of the St. John Branch of *The Engineering Institute* in Sept. 1919. He has always taken a deep interest in the activities of the Branch and the advance of the profession generally.

Calgary Branch

Arthur L. Ford, M.E.I.C., Secretary-Treasurer.
Floyd K. Beach, A.M.E.I.C. Branch News Editor.

Western Canada Irrigation Association Meeting

The Western Canada Irrigation Association held their annual meeting at Vernon, B.C. July 27 to 30, and it was well attended by irrigators and by engineers and administrators of various irrigation projects in the locality as well as by a number from the prairie provinces. Among the membership of *The Institute* from outside British Columbia were, — E. F. Drake, Associate. E.I.C., director of reclamation; J. S. Tempest, M.E.I.C., chief drainage engineer, Reclamation Service; H. S. Carpenter, A.M.E.I.C., deputy minister of public works, Saskatchewan; L. C. Charlesworth, M.E.I.C., president Irrigation Council, Alberta; G. N. Houston, M.E.I.C., secretary Irrigation Council, Alberta; A. S. Dawson, M.E.I.C., chief engineer, C.P.R. Dept. of Natural Resources; Arthur L. Ford, M.E.I.C., district chief engineer, Dominion Water Power Branch, Calgary; Victor Meek, A.M.E.I.C., acting commissioner of irrigation; W. H. Snelson, A.M.E.I.C., Brooks, Alberta; R. S. Stockton, M.E.I.C., Strathmore, Alberta; H. W. Meech, A.M.E.I.C., Lethbridge, Alberta.

The meeting was an unqualified success from every standpoint. A very well balanced programme included discussion of the problems of the individual irrigator in handling water and producing crops, as well as the larger engineering problems of handling and distributing water in large quantities.

A very interesting paper was presented by A. S. Dawson, M.E.I.C., on wood stave pipe in irrigation structures. Wm. Pearce, M.E.I.C., spoke on conservation of water and the necessity of making reservations for reservoir sites. L. C. Charlesworth, M.E.I.C., spoke on the progress of irrigation districts in Alberta. H. S. Carpenter, A.M.E.I.C., addressed the gathering on the need for irrigation in Saskatchewan.

Entertainment for the visitors was most lavishly provided and included two dinners to the guests, a dance at the Country Club, the courtesies of the Club for various pastimes, the use of numerous motor cars, and many other social courtesies.

At the conclusion of the meeting a vote of thanks to the hosts was moved by Hon. C. R. Mitchell on behalf of the Alberta guests and it was seconded by H. S. Carpenter, A.M.E.I.C., on behalf of Saskatchewan. The meeting places for next year were fixed for Maple Creek, Saskatchewan, two days, followed by two days at Brooks, Alberta.

Western Professional Meeting

The Western Professional Meeting of *The Institute* at Saskatoon on August 10th. to 12th. attracted a number of members from Alberta and early reports of the meeting indicate that it was well worth their time and trouble to go. Among the South Alberta members who attended are the following:—

Arthur L. Ford, M.E.I.C., Major G. H. Whyte, A.M.E.I.C., Major P. J. Jennings, M.E.I.C., G. W. Craig, M.E.I.C., B. L. Thorne, M.E.I.C., A. S. Dawson, M.E.I.C., D. T. Townsend, A.M.E.I.C., Major H. B. Muckleston, M.E.I.C., G. N. Houston, M.E.I.C., Wm. Pearce, M.E.I.C., S. G. Porter, M.E.I.C.

Lethbridge Northern Irrigation Project

Tenders were opened for concrete, masonry and timber trestle work, main canal. Contract was let to A. G. Creelman and Company of Calgary. A table of unit prices submitted by this firm is appended. The Canada Ingot Iron Company were successful in securing culvert contract. Their bid was low on Keystone Copper Steel. During June 154,000 yards of earth was moved on the project which was a good showing considering that the contract was only let during the early days of the month. During July 650,000 yards were moved and the work can now be said to be in full swing. About 500 men and 650 teams were engaged on actual construction. 7 elevating graders; 1 drag line; 2 locomotives and 20 cars; 2 steam shovels. While the number of teams and scrapers will not materially increase, the heavier equipment will be considerably augmented during the coming month. Some solid rock has been encountered on cut at the West end of Keho Lake Reservoir, but this is breaking well on drilling and blasting and should not cause delay even should it prove more extensive than at present apparent. There has been no actual shortage of labour but difficulty occurs in retaining men, particularly on scraper work for any length of time, probably because of the high winds, heat and dust. Wages for common labour have averaged $3.75 per 10 hours with board at $1.20, or $60.00 per month with board. Harvest will make considerable difference in the wage rates and some contractors are offering $75.00 per month with board.

Tenders for intake and flume at Old Man River will be called for during August, also for steel work and wood-pipe. The headworks tenders are being prepared and advertised and will close on September 17th.

Material Supplied	
Timber, 17.3 M.	40 00 M
Piling, 560 L. Ft.	40 ft.
Iron, 1,600 lbs.	10 lb.
Cement, 4,850 bbls.	4 15 bbl.
Reinforcement, 98,340 lbs.	06 lb.
Plant and Labour	
Machinery erected, 19,086 lbs.	05 lb.
Timber in place, 17.3 M.	60 00 M.
Piling driven lin. ft	.60 ft.
Coffer dam filling, 1000 cu. yds.	40 yd.
Excavation, 8,928 cu. yds.	50 yd.
Formed Surface, 171,000 sq. ft.	.12 sq. ft.
Concrete, mass, 2,177 cu. yds.	12 70 yd.
Concrete, reinforced, 1,697 cu. yds.	14 .95 yd.
Reinforcement placed, 98,340 lbs.	03 lb.
Filter gravel placed, 600 yds.	8 .00 yd.
Rehandling, 4,985 cu. yds.	30 yd.
Refilling, 3,716 cu. yds.	50 yd.
Waterproofing, 2 coat work, 55,600 sq. ft.	.07 sq. ft.
Rip rap, 1,200 cu. yds.	4 .00 cu. yd
Embankment, 5,000 cu. yds.	40 cu. yd
Trestles, 28.0 M.	70 .00 M.
Man-hours, 5,000	.45
Team-hours, 1,100	.80
	$134,719 95

Eight bidders submitted prices ranging from the above figure up to approximately $200,000.

Air Ministry Competition for Safety Fuel Tanks for Aircraft

The Air Ministry announces a competition with prizes to the extent of £2,000. for safety aircraft tanks which though seriously damaged will withstand severe shock such as that sustained in a heavy landing or crash without bursting or leaking. Enquiries should be addressed to the Secretary (R.D.1) Air Ministry, Kingsway, London, W.C.2, marked "safety fuel tank competition".

The tank is to be capable of being fitted within a space of two feet six inches by two feet by two feet and to have a capacity which must be within five per cent of thirty gallons. Any shape will be accepted. All necessary fittings to enable the tank to be mounted in a structure for testing purposes must be furnished by the competitor the maximum weight should not exceed 1.75 pounds, complete with fittings per gallon capacity.

Further particulars can be obtained from Headquarters of *The Engineering Institute of Canada*, 176 Mansfield Street, Montreal.

Town Planning Notes and Comments

H. L. Seymour, A.M.E.I.C.

NOTE: — *In order to make this column of wide interest to members of The Institute, personals and items of town planning interest will be appreciated. Address: H. L. Seymour, A.M.E.I.C., 40 Jarvis Street, Toronto.*

Town Planning Conference, Montreal

It has been decided that on the 29th. and 30th. of September, and the 1st of October, 1921, there will be held in Montreal a Town Planning Conference under the auspices of the Montreal Civic Improvement League and the Town Planning Institute of Canada.

It is expected that prominent town planners, not only from Canada but from the United States, will be present. Already a number of papers and exhibits have been promised to an extent that augurs well for the success of the meeting. Engineers will be interested in the programme which features the economic side of City Planning.

The 29th of September will probably be an all French day, while the last two days will be devoted principally to papers or discussion in English. The direct outcome of the Conference will probably be the formation of a Montreal Branch of the Town Planning Institute of Canada.

Town Planning Extension Course. University of Toronto

It has been announced that:

Town Planning or "city surgery" is the latest extension course arranged by the University of Toronto. This course is offered during the two weeks, January 9 to 21, 1922, and is expected to be both intensive and comprehensive. It has been initiated by Prof. Adrian Berrington of the Department of Architecture, who is an expert as well as an enthusiast in the subject of municipal improvement. Professors J. A. Dale, R. M. MacIver W. M. Treadgold, and probably others will co-operate and such subjects as housing and homing, the model city, roads, rail and waterways, civic self-control, vital statistics, the biology and the anatomy of towns, economic aspects of housing and town planning, housing and health, education and recreation, maps and map-reading, roads and pavements, will be dealt with.

The lectures, it is understood, are designed to appeal first of all to the expert — the architect, the surveyor, the municipal engineer, the landscape gardener, and all those who, being technically equipped, each in his own branch, yet desire more knowledge of the others' difficulties and points of view. The authority, academic or external, with which the lecturer chosen for each subject can speak, should render each lecture of interest, even to those who can themselves claim knowledge and experience of the particular subject under treatment.

The general plan of the course is the simple one of two lectures every morning, thus leaving time for discussion after each lecture; the afternoons, save for such as are taken up with visits to places of interest in Toronto, being devoted to work on actual problems.

The idea underlying the plan is that the students will have as much in the way of particular experience to give the lecturers as these, in their turn, have in the way of general ideas to give the students. It is not one of those courses where the student is expected to sit silent and just listen to lecture after lecture. On the contrary, it is hoped that the student will speak up for himself or herself. The organizers of the course definitely ask students to bring maps and plans, whenever these are to be had and figures and photographs, so that the problems discussed may be actualities. In this way it is possible that one or two solutions of value may be reached and a little practical work done.

The following corporate members of *The Engineering Institute* have been mentioned as external authorities lecturing in the Extension Courses: Noulan Cauchon, A.M.E.I.C., Ottawa. Messrs. E. L. Cousins, A.M.E.I.C., A. E. K. Bunnell, A.M.E.I.C., A. G. Dalzell, M.E.I.C., J. P. Hynes, A.M.E.I.C., and H. L. Seymour, A.M.E.I.C., of Toronto.

These lecturers will cover the following subjects:

The Use of Water Power and Irrigation.
The Toronto Harbour Scheme.
The Street Transport Problem.
Subdivision Development and Taxation.
History of the Survey.
Sunlight Planning and Zoning.

Preliminary Notice

of Applications for Admission and for Transfer

23rd August, 1921

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate member a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in September, 1921.

Fraser S. Keith, Secretary.

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*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option, Railway, Municipal, Hydraulic, Mechanical, Mining or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects, Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits cientific acquirements, or practical experience is qualified to co-operate with engineers n the advancement of professional knowledge.

> The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BUCKLEY—I. WALTER, of Sydney, N.S. Born at Manchester, England, July 29th, 1881; Educ., 2 years mech. engr'g., Salford Tech. Institute; 1 year mech. engr'g., Manchester School of Technology; 5 years ap'ticeship with Messrs. Galloways Ltd., Manchester, England, Mech. and Constrn. Engr'g. Works; 1901-03, erection engr. on constrn. work, for same firm; 1903-05, constrn. engr'g., and 1905-07, guarantee engr., and representative for the British Westinghouse Co., on the Mersey Railway Contract, Birkenhead, England; 1907-19, night supt. and at present supt., Dominion Iron & Steel Co., Sydney, N.S.

References: D. H. McDougall, G. D. Macdougall, H. Longley, A. W. McMaster, D. F. MacIsaac. K. G. Cameron.

DONALDSON—RALPH WALLACE, of Toronto, Ont. Born at Stratford, Ont., July 3rd, 1889; Educ., I.C.S. mech. dfting.; 1912-14, dftsman., Standard Sanitary Mfg. Co. Ltd.; 1915-19, overseas Can. Engrs.; 1920, dftsman., Steel & Radiation Ltd., At present dftsman.,Barber, Wynne-Roberts and Seymour, Consltg. Engrs., Toronto.

References: R. O. Wynne-Roberts, W. L. Malcolm, J. S. Galletly, H. L. Seymour, E. V. Deverall, O. M. Falls.

FRASER—JOHN HUGH, of Sydney, N.S. Born at Hopewell, N.S., Sept. 6th, 1880; 1896-1900, mach. ap'tice; 1900-02, journeyman machinist; 1901-04, foreman, mech. constrn.; 1901-07, foreman, rolling mills; 1907-16, master mech., rolling mills; 1916-18, asst. mech. supt.; 1918-20, asst. supt. of constrn., and at present mech. supt. Dominion Iron & Steel Co., Sydney, N.S.

References: H. Longley, G. D. Macdougall, D. H. McDougall, A. W. McMaster, H. E. Chambers, C. M. Odell.

KELSO—JAMES A., of Edmonton, Alta. Born at Roslin, Ont., in 1887; Educ., B.Sc., M.Sc. (Chem. Engr'g.), Queen's Univ., 1909; 1908 (6 mos.), chemist for Milton Hersey Co. Ltd., Montreal; 1909, asst. chief chemist, Vulcan Portland Cement Co., Ltd.; 1910, chief chemist, Vulcan Mill Canada Cement Co. Ltd., Montreal; 1911-13, chemist, Exshaw & Calgary Mills, same company; 1913-14, manager, Kelso Testing Laboratories, Calgary, also practice as consltg. chem. engr.; 1914, to date, Director, Industrial Laboratories, University of Alberta, and Prov. Analyst, Prov. of Alberta. Also consltg. chem. engr., Edmonton, Alta.

References: G. W. Craig, A. S. Dawson, R. S. L. Wilson, A. W. Haddow, F. S. Keith, D. J. Carter.

KENNEDY—MURRAY DOUGLAS ALEXANDER, of Gowganda, Ont. Born at Toronto, Ont., March 3rd, 1883; Educ., 3 years course, mining engr'g., Univ. of Toronto, 1908; Summer 1904, Goderich & Guelph Ry.; 1905-06, T. C. Ry., topog'r. part of time; 1908-09, 1 summer prospecting, 1 year asst. surveyor, O'Brien, Mine, Cobalt, and 3 mos. asst. surveyor and assayer, Tretheway Mine, Cobalt; 1909-10, mgr., Silvers Ltd. Mine, Gowganda; 1911-18, mgr., Beacon Consolidated Mine; 1918-19, surveyor and assayer Beaver Mine Cobalt, 1919-20, shift boss (underground), Temiskaming Mine, Cobalt; 1920 to date, mgr., Tretheway Silver Cobalt Mine, Ltd., Gowganda.

References: C. H. Mitchell, H. Sutcliffe, E. G. Hewson, J. A. Reid, H. G. Kennedy.

KIRK—DAVID LYONS, of Sydney, N.S. Born at New Jersey, U.S.A., March 16 th, 1880; Educ., Drexel Institute Penn'a.; 1897-1908, gen. constrn. work and shop lay-out, Penn'a Rld. Co., New-Jersey; 1909-11, plant and gen. constrn. work, DuPont Power Co., Delaware; 1911-13, generator and motor work, General Electric Co., New York; 1913-15, plant constrn. work, American Sugar Refinery, Penn'a.; 1915-17, heavy mach. and constrn. work, inspection of materials, etc., Bethleem Steel Co., Penn'a.; 1917-19, coke plant constrn. and gen. machinery, U.S. Steel Corpn. Co., Alabama; 1919-20, chem. plant constrn. and mach., Barrett Mfg. Co., Penn'a.; 1920, gen. plant constrn. and mach., Goodyear Tire & Rubber Co., Ohio.; Sept. 1920 to date, gen. dfting. estimating and checking, Dominion Iron & Steel Co., Sydney, N.S.

References: D. F. MacIsaac, K. G. Cameron, R. J. Fisher, H. Longley, A. W. McMaster.

LINDSAY—WILLIAM, of Wabana, Nfld. Born at Dundee, Scotland, Oct. 26th, 1883; Educ., Dundee Technical College; Assoc. Mem. Inst. Mech. Engrs., England; 1897-99, ap'ticeship with Wm. Robertson & Sons, Motor & Cycle Mfrs., Dundee; 1899-1902, with Robertson & Orchard Ltd., Mfrs. of textile and linoleum machinery, Dundee; 1902-10, with Fraser & Chalmers Ltd., Mfgrs. of mining machinery, steam engines, turbine, pumps and boilers; 3 years supt'ing the erection and starting up of various plants in the United Kingdom; 1910 to date, operating engineer in charge of power plant, hoisting and compressor plants of Nova Scotia Steel & Coal Co., Wabana, Nfld.

References: A. R. Chambers, C. B. Archibald, J. B. Petrie, J. B. Gilliatt, J. H. Morley.

NEWTON—JAMES BOUSTEAD, of Amarah, Mesopotamia. Born at Carlisle, England, Jan. 26th, 1885; Educ., 1902-05, engr'g student under articles to H. C. Marks, M.E.I.C., Borough Engr. and surveyor, Carlisle, England; maths. and bldg. constrn. (Honours), South Kensington; Member, B.C. Tech. Assn.; 1905-09, junior engr'g. asst.,1909-10, chief engr'g asst., H. C. Marks, M.E.I.C.; engr'g asst. and surveyor to F. W. Spurr, city engr. and surveyor, York, England; engr'g. and surveying asst. to Herman & Burwell, Dom. & Prov. Land Surveyors and Water Engrs., Vancouver, B.C.; 1912-16, mgr. and partner, Taylor & Bell-Irving, Engrs. and Surveyors, Vancouver; 1916-19, overseas with Royal Engrs. in Mesopotamia, A/Capt.; 1919-20, private practice as engr.,Vancouver; 1919-20, irrig. engr. on contract, Mesopotamia Public Works; Aug. 1920, appointed irrig. officer, P.W. Mesopotamia, April 1921, appointed district irrig. officer in charge of special project, District 1.

References: E. G. Matheson, A. D. Creer, R. Snodgrass, B. C. Bordessa, R. Bell-Irving, J. N. Anderson.

WALKER—MILES, of Gagetown, N.B. Born at Retford, Notts., England, May 22nd, 1881; Educ., 1895-98, Cheltenham College, England; premium ap'tice at Great Western Rly. Works, Swindon, England for 5 yers course, afterwards retained in drawing office, total time 1898-1904; 1905-06, member of firm, Hayter & Walker, Blantyn, Nyasaland, Engrs., Bldrs. & Govt. Contractors; 1906, bridge engr., Shire Highlands Rly., Nyasaland; 1907, chief agent, Blantyn Building Co., Nyasaland; 1908-09, contracting; 1909-10, chief mechanical engr., The Durman Syndicate Gold Mine, North Eastern Rhodesia; 1910-11, working own mine in Portuguese East Africa; 1912, mining engr., Rhodesia Mines Trust, Portuguese E. Africa; 1912-13, chief mech. and civil engr., The Mololsla Development Syndicate, P.E.A.; 1913-16, chief asst. engr. and acting chief, The Nundydroog Gold Mining Co., India; 1916-17, chief mech. enfr. of hydro-electric scheme, The Andra Valley Power Supply Co.; 1917-20, works mgr. Jhansi shops and later district locomotive supt., Great Indian Peninsula Rly., India. At present settling in Canada and open for engagement.

References: E. T. P. Shewen, A. Gray, C. E. W. Dodwell, A. G. Tapley, G. Stead, W. C. Ewing.

FOR TRANSFER FROM CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

MICHIE—VICTOR, of Boissevain, Man. Born at Balmoral, Scotland, June 4th, 1882; Educ., Gordon's Technical College, and 1 year special student, Surveyor's Institute, South Kensington, London; 1899-1903, under articles to John Aird & Co.; 1904-06, instr'man., G.T.P.Ry.; 1906-08, with C.P.R. as instr'man. and res. engr.; 1909-1914, asst. engr. on constrn., C.P.R.; 1914-16, Capt., Overseas Imperial Forces; 1917-18, D.I.O., M.D. No. 12, Regina, Sask.; 1920, inspecting engr., G.T.R., Arbitration Case; At present, mun. engr., constrn. of highways, Municipality of Morton.

References: F. S. Keith, G. L. Guy, J. W. Porter, W. A. James, J. G. Reid, J. G. Sullivan, J. N. deStein, T. Turnbull.

FOR TRANSFER FROM CLASS OF JUNIOR TO A HIGHER GRADE

BROWN—GEORGE SANDLES, of Lethbridge, Alta. Born at Hendfield, Sussex, England, March 12th, 1892; Educ., Private study and I.C.S.; 1911-12, rodman, Alberta Central Rly.; 1912-15, rodman and instr'man, Kootenay Central Rly., C.P.R., B.C.; 1916-19, Can. Engrs. and overseas with Can. Rly. Troops., instr'man and dftsman on rld. work; 1919 (July-Dec.) senior instr'man., Dec. 1919 to April 1920, office work, and April to Oct. 1920, in charge of work in the field, Taber Irrigation Project; 1920 to date, asst. engr. in charge of hydrometric and misc. field work, D.N.R., C.P.R., Lethbridge, Alta.

References: S. G. Porter, A. S. Dawson, H. B. Muckleston, C. M. Arnold, F. S. Dyke, H. G. Cochrane, G. P. F. Boese, H. Lumsden, R. S. Lawrence.

HUGHES—EDWARD, of Michel, B.C. Born at Llanrydd, North Wales, Jan. 10th, 1896; Educ., 4 years Univ. of Alta.; 1907-10, Dom. Land Survey Work; 1910-11, with G.T.P., Alta. Coal Branch; 1911-14, with G.T.P., Alta. Coal Branch and G.T.P. Rly., instr'man. and bridge insp'r. on rly. constrn.; 1914-15, instr'man. on rly. and bridge constrn., Pacific & Great Eastern Rly.; 1915, (May-Sept.), instr'man, on rly. constrn., Alta & Great Water-Ways Rly.; 1916, (May-Oct.), leveller on D.L.S.; 1917 (Apr-June), dftsman. on rly. location, Edmonton, Dunvegan & British Columbia Rly.; 1917 (June-Oct.), and 1918 (May-Sept.), asst., Geol. Survey at Ottawa; 1918-19, mine surveyor, North American Collieries; May 1920 to date, mine surveyor and at present engr., for the Crow's Nest Pass Coal Co. Ltd., Fernie, B.C.

References: C. Ewart, R. W. Jones, A. Lightall, C. H. Pozer, R. S. L. Wilson, A. Cummings, L. E. Silcox, H. A. Dixon.

MAWHINNEY—WILLIAM GEORGE, of St. Lazare, Man. Born at Holland, Man., June 26th, 1892; B.C.E., Univ. of Manitoba, 1915; 1910 (summer), C.P.R. location; 1911 (summer), G.T.P., mtce.; 1912 (summer), Midland Rly. of Man., mtce;. 1913, Dom. Govt. on N. Sask. River Survey; 1916-19, overseas; 1919-21, munic. engr., rural municipality of St. Clements, Selkirk, Man.; May 1921, to date, munic. engr., rural municipality of Ellice, St. Lazare, Man., in charge of road constrn. under the Prov. Good Roads Board.

References: M. A. Lyons, H. R. Urie, W. H. Hunt, G. L. Guy, P. Burke-Gaffney, A. J. Taunton, E. E. Brydone-Jack.

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OCTOBER 1921

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The Self-Corrosion of Cast Iron and Other Metals in Alkaline Soils

An outline of field research work in Winnipeg; electro-chemical principles, soil analysis, effect of moisture content and salts in solution, products of corrosion — tables of experimental results.

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and
Dr. J. W. Shipley, F.C.I.C., Assistant Professor of Chemistry, University of Manitoba.

Paper presented at the Tenth General Professional Meeting, Saskatoon, August 11th, 1921.

Origin of the Investigation

The corrosive action of the alkaline salts upon Portland cement concrete being a matter of common knowledge both among engineers and the public, it now becomes our duty to call attention to a new set of facts, showing that the self-corrosion of cast iron and of other commercial metals used in buried structures is inevitable, in the presence of the same group of soil salts that destroy concrete.

This investigation was primarily undertaken in order to derive proof that the external corrosion of city water mains, in areas where any stray electric current present would necessarily be flowing into the pipe and not out of it, must be due to the action of the soil and not to the passage of stray current, *which can only dissolve iron where it leaves a pipe.* A great many such instances of corrosion have been observed in Winnipeg which cannot be attributed to the proximity of other pipes, tracks or cables. Evidently some cause other than stray current was operating in such localities.

Although incomplete, we consider the results conclusive enough to submit for the information of the engineering profession, believing that the safety of metal underground structures is in the same category as the safety of concrete structures, as a matter of public concern.

The electro-chemical principles are not new to professional chemists, though possibly less familiar to engineers in general practice. The following facts could have been ascertained at any time during the past fifteen years, had the necessity for the research been realized.

Electro-Chemical Principles

Every metal in contact with water tends to dissolve in the water, or in other words to pass from its metallic atomic condition to its ionic condition independently of any e.m.f. impressed from outside. This tendency to go into solution is termed solution pressure. Such metals as sodium, potassium, and magnesium, the alkaline metals, very readily go into solution and are conceived to have a high solution pressure, while gold, mercury and platinum are metals with very low solution pressures. These solution pressures in fact correspond to the positions of the various metals in the so-called electro-chemical series of elements, tabulated in the text books.

Iron occupies an intermediate position in the electro-chemical series, but is considerably above hydrogen, which is considered as a metal in the series on account of its electro-chemical behaviour. Iron has a higher solution pressure than hydrogen and can therefore displace it. Consequently the iron ions entering a solution are able to drive out of solution any metallic ions occurring below it in the electro-chemical series, or any hydrogen ions. Take the case of iron in water. Water which is electro-chemically regarded as the combination of an H ion with an OH ion easily provides the displaceable H ion whose lower solution pressure causes its ready exit from the solution in the face of the higher solution pressure of the iron ion. In actual experiment iron was found by Walker to go thus into solution in the purest of water free from dissolved oxygen or carbon dioxide. A perfectly dry surface of iron will not corrode even when exposed to air or pure oxygen. It will only corrode if moisture be present where there is a hydrogen ion to be displaced. Rusting should therefore be conceived, fundamentally not as an attack of oxygen, but as a retreat of hydrogen.

According to the electro-chemical conception, when an atom of metal passes into solution, it assumes a positive charge of electricity and leaves the metallic mass from which it is separated, negatively charged. Metallic ions and hydrogen are therefore conceived of as having positive charges and travelling in the same direction as the electric current. The OH ions and the acid radical have negative charges and travel against the current. This is true whether the act of going into solution generates the electric current, as in a primary battery, or whether the liquid solution is decomposed and its elements driven out of solution by an impressed electric current. The electro-chemical mechanism is therefore somewhat analagous to the reversible property of an electric current on a movable wire in a magnetic field, in which the current produces motion, or the motion can produce current.

The self-corrosion of iron is therefore now recognized as being in all cases an electrolytic reaction, carried out in a water solution.

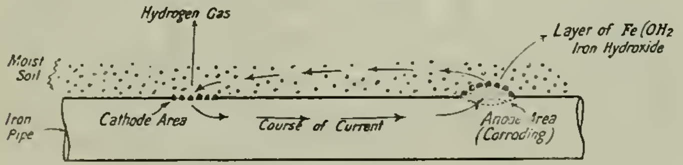

Diagram 1

Effect of potential difference between two points in iron pipe in moist soil, due to difference in composition of pipe structure or soil.

The distance between anode and cathode areas may be infinitesimal.

Water is slightly ionized into hydrogen ions and OH ions, according to the following equation

$$H_2O = H + OH$$

and accordingly it is a reservoir from which a solution may draw an indeterminate amount of either hydrogen ions or OH ions. If a chemical reaction fixes the OH ion as an insoluble substance, the solution is left with an excess of hydrogen ions. Iron forms an insoluble substance with the OH ion according to the following equation

$$Fe + 2OH = Fe\ (OH)_2$$

So far we have considered pure water only. Coming to the effect of impurities in the water, they either stimulate or inhibit the solution of iron.

Corrosion is stimulated by substances which increase the concentration of hydrogen in a solution in contact with iron, such as the following:—

Acids, such as H_2SO_4 (Sulphuric acid)

Acid salts, such as $Ca\ H\ (CO_3)_2$ (Calcium bicarbonate)

Salts hydrolizing to give ionizable acids such as:—

$CaSO_4 + 2H_2O = H_2SO_4 + Ca\ (OH)_2$. (Sulphuric acid and calcium hydrate). These substances all stimulaet corrosion because they provide more H ions for the iron to displace.

On the other hand hydroxyl ions (OH), which are provided by bases such as Na_2CO_3 and all alkali hydrates, inhibit corrosion, because it is impossible to have any free hydrogen ions present in a solution containing any free hydroxyl ions. In other words a true alkali solution like NaOH is non-corrosive, while a solution that tends even ever so slightly to be acid, will tend to dissolve iron. Certain neutral salts in the presence of water hydrolize, thus offering free hydrogen ions which accelerate corrosion.

The effect of the presence of a salt which provides the additional H ions thereby stimulating the passing of Fe into solution, is shown in the attached equations. Calcium sulphate is chosen because its action is typical and it is widely distributed in the Winnipeg district, and doubtless elsewhere in Western Canada. The action of magnesium sulphate is identical, but is probably more rapid.

$$CaSO_4 + 2H_2O = H_2SO_4 + Ca\ (OH)_2$$
$$H_2SO_4 + Fe = Fe\ SO_4 + H_2.$$

Hydrogen is thus given off as gas and disappears.

$$Fe\ SO_4 + Ca\ (OH)_2 = Fe\ (OH)_2 + CaSO_4$$

$Fe\ (OH)_2$, ferrous hydrate, is insoluble, and is the visible product of corrosion. The reaction has ended with the production of $CaSO_4$, with which it started. $CaSO_4$ promptly reacts with more of the ground water from the ground and the action thus continues indefinitely with the continual evolution of hydrogen as long as water is present, and with the formation of ferrous hydrate, the first visible product of corroded iron.

It is thus seen that the tendency of iron is to form ferrous hydroxide. If oxygen is present in the solution or has access to the ferrous hydrate from the air, it quickly oxydizes the ferrous to the ferric hydrate, $Fe(OH)_3$ which is the reddish yellow product commonly called iron rust.

Soils of the Winnipeg District

Professor Williams' description exactly fits the soils of the Winnipeg district. Here the saline deposits occur at levels of from 4 to 12 feet below the surface. They have crystallized out in the clay and frequently they occupy, as aggregations of crystals, the spaces at one time filled by the roots of a tree. They are very commonly found either in contact with, or within a few inches of the pipe where a water main has failed from corrosion. The sulphates are the most widely distributed, and calcium carbonate is very common, which, in the presence of CO_2 in the ground water, becomes the bi-carbonate $Ca(HCO_3)_2$, a solution which provides two more hydrogen ions per molecule, making the solution slightly acid in its effect, thus accelerating the solution of metals, particularly iron. The presence of a large quantity of carbonate in the soil readily accessible to ground water carrying CO_2 in solution, thus constitutes an unlimited reservoir for the creation of corrosive bi-carbonates.

Besides the foregoing there is a small percentage of phosphate, also occasionally an extremely variable percentage of nitrate, which is suspected to accelerate the self-corrosion of lead pipe in electrically negative areas.

Preliminary Examinations of Soils

One of the first things done was to examine about 18 samples of soil from various parts of the city, mostly from excavations around water pipes. Some were taken from the middle of the business district, and some on the outskirts of the city. Of the 18 samples, 9 were from places where pipes had been corroded to destruction, 7 were from places where pipes had been visibly corroded but not seriously, while 2 more were taken from excavations where pipes had never been laid. Some were from positive and some from negative areas.

These first proximate analyses were made by leaching a little of the soil sample with distilled water, filtering, and testing the clear filtrate for the dissolved chlorides and sulphates. The sulphate radical was found in every single sample, indicating its universal distribution throughout the soil of the city.

It is very significant indeed, that wherever a cast iron pipe has been corroded to destruction, whether near an electric railway power station or a mile or two distant from it, the soluble sulphates of both calcium and magnesium were invariably found in the soil close to the pipe, sometimes in crystal form, actually in contact with the pipe, which can only mean that the ground water in contact with the pipe was actually a concentrated salt solution.

First Experiments and Results on Cast Iron

In May 1920 several series of laboratory experiments were started.

The object of the first series was to determine which salts would cause the most pronounced corrosion, and whether dilute or concentrated salt solutions showed the greater effects. Both individual salts and mixtures of salts were utilized, both dilute and concentrated. Pieces cut from new cast iron pipe, cleaned and weighed were immersed in the solutions entirely without any impressed e.m.f. and heated to about 90°C. Distilled water was added as evaporation proceeded. During the first 25 days the solutions were heated for about 6 hours per day, and at the end of 40 days pieces of iron were taken out, cleaned and weighed.

Table "A" gives the general results for the individual salts, dilute and concentrated. The results with mixtures of salts were not so marked, and for the sake of brevity have been omitted. The results are listed in the order of magnitude of corrosion, and it will be noted that the concentrated solution of magnesium sulphate comes first.

Table "A"

Corrosive effect on Cast Iron of Soil Salts in Dilute and Concentrated Water Solutions.

Listed in order of Magnitude of Corrosion

No.	Salts used	Loss of Weight in Grams.		Rusting	Pitting
1	$Mg\,SO_4$	conc.	0.212 ✓	most rusted, both heavy Fe″ and Fe‴	graphitic pits along edge
2	$Mg\,Cl_2$	"	0.209 ✓	at once, both heavy	pits 1/16″ deep, several
3	" "	dil.	0.205	" "	" " " "
4	$CaSO_4$	sat.	0.189 ✓	" "	graphitic pit ½″ circ.
5	$Mg\,SO_4$	dil.	0.157	very much rusted, both heavy	several pits, two 1/16″ deep
6	$Ca\,(HCO_3)_2$	conc.	0.138	at once, both Fe″ and Fe‴	" small pits
7	"	dil.	0.136	little at first more Fe″	" "
8	$CaCl_2$	conc.	0.132 ✓	rusting at once, both Fe″ and Fe‴	numerous small pits
9	$Na\,Cl$	conc.	0.111	at once, both Fe″ and Fe‴	1/16″ deep, several
10	Na_2SO_4	conc.	0.092	none at first Fe″ and Fe‴	slight
11	$CaSO_4$	dil.	0.081	at once, both Fe″ and Fe‴	several pits
12	$CaCO_3$		0.063	none at first	one pit
13	$Na\,Cl$	dilute	0.048	both Fe″ and Fe‴	slight
14	$Ca\,Cl_2$	dil.	0.042	little at first, both	a few pits
15	Na_2SO_4	dil.	0.020	slight, both Fe″ and Fe‴	
16	$NaHCO_3$	dil.	0.014	none at first, little of both	slight
17	Na_2CO_3	dil.	0.012	" " Mostly Fe″	none evident
18	$NaHCO_3$	conc.	0.011	slight, all Fe‴	slight
19	Na_2CO_3	conc.	0.007	none at first, little of both	none evident
20	$Mg\,CO_3$		0.006	trace of rusting only	no pitting.

The table also indicates that sodium carbonate (not bi-carbonate) inhibited corrosion. This preventive action was also indicated in the results obtained with the mixtures of salts where sodium carbonate was present. Even calcium carbonate was more corrosive than most of the sodium salts.

It is to be noted that the calcium bi-carbonate solutions stand sixth for the concentrated and seventh for the dilute solutions, showing the effect of the two extra hydrogen ions per molecule of bi-carbonate, in facilitating the solution of iron.

In almost all instances the corrosion was accompanied by incipient graphitic pitting, deep enough to dig out with the point of a knife, and differing in no respect except size, from the pitting on corroded city water mains. The products of corrosion from the cast iron were usually a mixture of ferrous and ferric iron compounds. The iron first goes into solution as ferrous hydrate and is oxidized later into the ferric hydrate by oxygen from the air.

The next series of experiments was to demonstrate the effect of differences of concentrations of salt solutions in contact with water pipes, which is a condition that occurs naturally in the soil in and about Winnipeg. Several concentration cells were set up with walls of paraffine wax on a piece of clean cast iron pipe. Corrosion occurred on the pipe in every instance, and always at the spot which was in contact with the more dilute solution. The results are given in Table "B", and the action is shown on Diagram 2.

Table "B"

Galvanic Electrolytic Cells of Diverse Concentration on cast Iron.

No.			
1	$NaCl$	dilute to $NaCl$ conc.	rusting on dilute only.
2	$MgSO_4$	" " $MgSO_4$ "	" " "
3	$MgCl_2$	" " $MgCl_2$ "	" " "
4	Na_2SO_4	" " Na_2SO_4 "	" " "
5	$CaSO_4$	" " $CaSO_4$ sat.	" " "
6	Na_2SO_4	solution " $CaSO_4$ solution,	—$CaSO_4$ rusted.
7	Na_2SO_4	" " $MgSO_4$ "	—Na_2SO_4 "
8	$MgCl_2$	" " $CaSO_4$ "	—$CaSO_4$ "

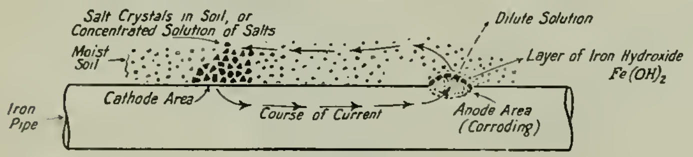
Salt Crystals in Soil, or Concentrated Solution of Salts
Dilute Solution
Moist Soil
Layer of Iron Hydroxide $Fe(OH)_2$
Cathode Area
Course of Current
Anode Area (Corroding)
Iron Pipe

Diagram 2

Effect of Different Concentration of Soil Salts in producing corrosion of Iron Pipe in moist soil.

The distance between anode and cathode areas may be infinitesimal.

A third set of experiments was made with concentrated solutions of different salts on bars of cast iron, each immersed in what may be called a gravity cell, consisting of a glass cylinder, containing a concentrated solution of one salt below, and a dilute solution of another salt above, gravity retarding the mixing. In these experiments local galvanic action appeared to be set up in the concentrated solution, while corrosion occurred at the upper end of the bar in the dilute solution. Table "C" gives the results. In numbers 7 and 8 in this table the solutions were of uniform mixture and rust was distributed over the whole surface. These gravity cell experiments were continued for 9 months, at the end of which time the products of corrosion were carefully removed, and weighed in order to determine the amount of iron actually dissolved. It is to be noted that in sample number 6, 3.2 grams of iron were removed from 112 sq. c.m. in 9 months by self-corrosion.

A fourth set of experiments was made to demonstrate the direct action of the soil itself, on small pieces of cast iron pipe. The samples were treated for 40 days, exactly as those described in Table "A". The amount of corrosive material in contact with the iron was, of course, much smaller than would occur in natural ground as the quantity of soil was necessarily limited by the size of the beaker, and there was no free movement of the water such as occurs under natural conditions with an unlimited supply. Corrosion occurred, of the same nature as that from the salts above, shown in Table "A", but the pitting was not so clearly defined.

Table "C"

Corrosion of cast Iron in Gravity Cells for Nine Months

No.	Salt Solution	Area of Iron exposed.	Weight of Iron removed by corrosion	Nature of Surface corroded
1	$NaCl$ above $MgCL_2$ below	84 cm.	2.0 grams.	somewhat pitted but rather uniform.
2	$MgSO_4$ above $NaCl$ below	98 cm.	1.8 "	deeply pitted above, pits ⅛ inch deep. Cone and crater effect.
3	Same as 2, but mixed.	132 cm.	1.9 "	graphitic areas with a few pits above.
4	Na_2SO_4 above $MgSO_4$ below	90 cm.	0.7 "	graphitic areas slight pitting.
5	$MgSO_4$ above Na_2SO_4 below	112 cm.	3.2 "	graphitic areas with a few deep pits.
6	Na_2SO_4 above $MgCl_2$ below	132 cm.	2.4 "	pitting quite general in patches.
7	$MgSO_4$ dilute	112 cm	0.6 "	uniform corrosion with little pitting.
8	$MgSO_4$ above $NaCl$ below	112 cm.	1.2 "	corrosion fairly well distributed.

The samples of soil were all taken from excavations made when repairing water mains that had been perforated by external corrosion in various parts of the city and from the excavation for Eaton's warehouse. The results are given in Table "D".

Table "D"

No.	Soils.	Loss in Weight in grams.	Pitting.
1	Powers & Alfred break—2 ft. from break	0.202	pitted.
2	Hargrave & Portage, around pipe	0.094	several small pits.
3	Dorothy & Logan break—3 ft. from break	0.082	none observable.
4	Dorothy & Logan break—around pipe	0.075	none obervable.
5	Hargrave & Portage,—6" below pipe	0.059	pitted.
6	Princess & Bannatyne—2 ft. from pipe	0.058	slightly pitted.
7	Powers & Alfred break—around pipe	0.056	pitted.
8	Eaton's Excavation, brown layer	0.054	numerous small pits.
9	Glasgow St. break—near pipe	0.052	pitted.
10	Typical Encrustant, Eaton's	0.035	pitted.
11	Princess & Logan,—around pipe	0.023	slightly pitted.
12	Princess & Logan,—2 ft. from pipe	0.018	pitted.

All lost weight, all but 2 pitted.

Conclusions

From the foregoing, the following conclusions were drawn:—

1. The corrosion of cast iron by the salt solutions found in natural soil is readily accomplished under natural conditions without access of stray current. This corrosion is of the so-called graphitic pitting type by which is meant the commonly observed condition of the material remaining in place, which is invariably of a soft spongy texture with part of the iron dissolved out, the remainder resembling graphite in consistency.

2. Magnesium salts are the most corrosive of the soil salts, and magnesium sulphate which was found wherever a cast iron pipe had been destroyed is apparently the most effective of the salts experimented with.

3. Local action induced by naturally occurring concentration cells may easily be a factor in the pitting of cast iron exposed to salts of varying concentration.

4. Slight pitting corrosion was found in pieces of cast iron exposed to the action of small samples of wet soil and intermittently heated, even in the short period of 40 days, and with only a limited supply of water as compared with conditions in natural ground, no impressed e.m.f. being present.

Products of Corrosion on Cast Iron Pipes

The products of corrosion appear in two forms, first the scale and the iron compounds that form in the clay immediately upon and adjacent to the pipe, and secondly the residual matter in the so-called pits in the wall of the pipe itself. These were examined separately.

The scale was loosely adhering and contained considerable quantities of iron. It varied in colour, thickness and consistency, but when first uncovered was usually a very dark blueish green turning yellowish red on exposure to the air. In all places where there was any quantity of scale it was noticeable that the moist clay removed from immediate contact with the pipe was saturated with this same dark greenish ferrous oxide which turned the clay practically black. This was particularly noticeable in the case of clay that was packed against the end of a bell at a joint, the angle made by the joint being apparently a convenient collecting place for a considerable mass of this fresh ferrous oxide, which is the first product of corrosion. Doubtless its presence at this particular spot is very often due to slight but continuous leakage through a pin hole in the lead joint. In very many places the greenish black ferrous oxide was present in much larger quantity than the reddish yellow ferric oxide, doubtless because the surrounding clay prevented access of sufficient atmospheric oxygen required for the formation of the latter. This condition was quite marked on a hydrant casing at the Manitoba Gypsum Works on the outskirts of Winnipeg, which is a mile distant from the nearest car tracks. The soil here was full of magnesium sulphate and chloride and the soft pasty scale was ¾" thick on the pipe.

Table "E" gives analyses of several samples of scale.

Table "E"

Nature of Iron in Pipe Scale.

Location of Pipe	Metallic iron %	Ferrous iron %	Ferric iron %	Remarks.
Ellice & Donald	1.4	30.0	7.4	slightly magnetic
Manitoba Gypsum Works	4.2	9.7	13.0	"
Bannatyne & Princess	0.4	12.5	0.2	non "
Stock Yards, St. Boniface	1.1	23.1	12.5	slightly "

Some analyses were also made of the residual matter in the pits. These pits are soft, porous, honey-combed mass of the pipe remaining in place and still preserving the form of the pipe until ruptured by the pressure which it can no longer withstand. The substance of a pit may not differ in outward appearance from the uninjured wall of the pipe adjacent to it, but an inspection with the end of a knife blade discovers the pit and the soft mass can be easily dug away. This soft spongy residue consists of such of the material of the pipe as possesses a lower electro-solution pressure than iron, together with residual iron not yet dissolved and hydrated iron. The metallic iron not yet removed may have been protected mechanically from the ground water by the graphitic-silicious matter in the residue. The large proportion of carbon gives the residue the consistency of graphite, and this sort of pitting is frequently called "graphitic."

Table "F" contains the results of this analysis for several pipes from representative localities. The first two were taken from near the centre of the city, but where the pipes would generally have been positive rather than negative to the track rails. The other three samples were outside the range of stray current, having been ½ a mile to 1¼ miles outside any probable path of the electric railway return. The first two samples had been in the ground the longest, which accounts for there being less metallic iron remaining in them.

Table "F"

Composition of Matter in Pits on Cast Iron Pipes.

Location of pipe	Metallic iron %	Ferrous iron %	Ferric iron %	Silicious graphitic residue %	Remarks
Portage & Hargrave..	26 2	23.0	2.2	30.4	pitting ⅜″ deep
Edmonton & Qu'Appelle...	35.2	16.6	10.4	25 6	" " "
Stock Yards, St. Boniface...	52.0	17.4	8.9	13.2	" ⅛″ "
Stock Yards, St. Boniface...	41.4	24.6	4.2	18.4	more than "
Selkirk Mental Hospital...	49.2	18.4	9.1	17.8	and sulphur 1.1% pitting ¼″

Phosphate and Sulphide in Corrosion Products

We have found corrosion products other than the foregoing which point to further complexity of the corrosion process. Ferrous phosphate has been identified in the graphitic spongy residue in the pits of corroded pipes, being conspicuous by its light blueish green color. As it could hardly have been present in the original iron, we conclude that it was formed during the process of corrosion. It has not hitherto been reported to our knowledge as a product of stray current electrolysis, and its presence is as yet an unsolved problem.

Iron sulphide was also found to be nearly always present in the pits and in the scale from both the inside and the outside of pipes, not only within the city, but several miles outside the electric railway area. Experiments were made with cast iron and soil samples in glass bottles to try and determine whether the sulphide was the result of self-corrosion, or of stray current corrosion, but it was found to be present in both cases. The sulphur required for its formation is probably contributed by the free sulphur mixed in the original cast iron, but it is possible that sulphates in the soil may be reduced to sulphides by the electro-chemical reactions. Sulphides having been found in wood and clay from the butts of poles shortly after their removal from the ground, it is also suspected that sulphur-forming bacteria may assist in the formation of sulphides, as the bacteria are known to exist in this region.

The Moisture Content and the Electrical Resistance of Soil

The moisture content of the samples of soil collected in this investigation varied considerably. The electrical conductivity of the soils is a function of the moisture content as well as of the salt content, and it was deemed desirable to measure the electrical resistance and determine the moisture content of about 50 samples taken from various places.

Eighteen of the samples were taken directly from off water pipes, and the average moisture content was 28.75%, the range being from about 20% to 35%. The resistance of these same 18 samples averaged 570 ohms per cu. cm., which is a very low average rating of soil resistance. One was as low as 206 ohms, while another was 1085 ohms, the difference in these two instances being probably due more to difference to the salt content than the moisture content of the samples.

In several cases the resistance of the soil was measured twice, once in its natural condition as received, and subsequently in a saturated condition, and the results showed that when saturated the same soil would have its resistance reduced to only about one-quarter of its resistance when in its natural state.

In contrast to the foregoing samples of limy clay silt soils, the same measurements were made on a sample of coarse gravel backfilling next a water pipe in St. Boniface which showed only 3.4% of moisture and a resistance of 37,000 ohms per cu. cm. which was reduced on saturation to about 12,750 ohms.

In the face of the above comparison it is not surprising that pipes laid in gravel and similar porous soils are very seldom troubled with self-corrosion.

The moisture content varies indeterminately with depth. Sometimes the dried soil is above, sometimes below, and there is no way of foretelling what the order will be at any one spot. The character of the soil varies at different levels and the capacity for holding moisture varies with the character of the soil. Clay soils are well known to be most tenacious of water.

One sample of soil was taken from around a gas pipe in a limy silt soil at Edmonton and St. Mary's Street, Winnipeg. The pipe was about 4 feet down. The moisture content was only 4.5% and the resistance was 1965 ohms per cu. cm., or about 3½ times the average resistance of the 18 samples taken from the water pipes. This fact is of particular interest also, because the soil around this gas pipe was comparatively dry, while in samples taken 2 or 3 feet directly above and below, the moisture content was 3 or 4 times as great, and the electrical resistance less than one-half that of the soil directly around the pipe.

This single instance of the observed difference in the moisture of soils on gas pipes and water pipes respectively, confirms a statement made to the writer by the manager of the Gas Department of the Winnipeg Electric Railway Company, that soil around gas pipes is generally dryer than around water pipes, this being presumably due to the generally average higher temperature of illuminating gas, above the average temperature of city water. This single discovery above reported may need further confirmation, but it certainly points to the probability, that the reason why the gas pipes in the City of Winnipeg have so far not been damaged by corrosion to any extent in comparison with, the water pipes, is because of less moisture in the soil immediately surrounding the gas pipes. Both sets of pipes are of about the same age, and the joints are made in the same way, with lead, and both are equally exposed to stray current.

Complete Soil Analyses

It was deemed desirable to have complete analyses made of a number of typical soil samples collected from representative areas in the Winnipeg district. The water soluble content was first determined and later the total analysis, on the basis of the hydrochloric acid soluble constituents as recommended by the Bureau of Soils at Washington and the Dominion Department of Agriculture at Ottawa. Tables "G" and "H" give the water soluble and the soil constituents respectively.

Referring to Table "G" in particular, it will be noted that the 5 samples show from nearly 1% to 1-1/3% of water soluble salts out of the total weight of the soil. At the places where these 5 samples were taken corrosion of water pipes had been particularly severe, with the exception of the Jubilee and Pembina sample which was discovered by accident and analyzed because of the very large crystal aggregates discovered, which are of calcium and magnesium sulphate.

Table "G"
Water Soluble Salt Content of Soils.

Soil.	Grams per hundred thousand grams of soil.						
	Ca	Mg	Na	So_4	Cl	CO_3	Total.
Glasgow Street	3	9.7	trace	20	4	26	62.7
Assiniboine Substation	40	9.7	none	39.6	14	42	145.3
Weston Shops	30	12.3	"	36.3	16	17	111.6
Cement Mills	32	9.3	10	46	18	41	156.3
Jubilee & Pembina (no pipe at this place)	223	96.0	none	620	6	25	970.0*
Broadway & Kennedy	258	78.4	39	840	90	30	1335.4*
Portage & Main	52	17.6	none	34	15	48	216.6
Transcona Main (C.P.R.)	71	17.6	none	109	4	27	228.6
Bannatyne & Princess	258	96.0	trace	937	15	18	1324.0*
Selkirk Mental Hospital (lead pipe excavation)	77	13.6	"	49	10	49	198.6
Selkirk Mental Hospital water main	40	10.4	none	66	10	15	141.4
Selkirk Mental Hospital off pipe main	26	10.4	"	48	8	4	96.4
Selkirk Mental Hospital off east elbow main	27	17.6	"	84	13	2	143.6
Godfrey & Harrow	50	18.0	trace	79	14	5	166.0
Stock Yards	80	14.0	none	90	14	24	222.0
Manitoba Gypsum Wks.	243	50.0	6	630	81	35	995.0*
General Hospital	34	17.5	trace	60	18	30	159.5
River Ave. East of Osborne Street	210	90.0	none	590	14	35	939.0*
Man. Gypsum—soil water around valve	41	139.5	10	200	31	13	424.5

* 5 out of 19, heavy, and damage to pipes extensive.

Table "H"
Soil Constituents in Samples Dried at 105°C.

No.	Soil	SiO_2 and Insoluble %	Fe_2O_3 %	Al_2O_3 %	P_2O_5 %	CaO %	MgO %	Na_2O %	CO_2 %	SO_3 %	Cl %	H_2O and Organic %	Total %
1	Selkirk Mental Hospital (off lead service)	54.8	4.5	10.3	0.22	10.3	3.1	0.48	13.1	0.70	0.18	3.0	100.7
2	General Hospital	43.0	1.9	5.6	0.15	17.0	7.8	0.41	23.8	0.40	0.07	0.2	100.4
3	Portage & Main	59.4	5.0	11.7	0.25	8.3	1.5	0.48	10.7	0.20	0.07	3.0	100.7
4	Jubilee & Pembina	59.4	5.0	10.2	0.26	7.6	3.3	0.26	5.2	4.70	0.04	4.4	100.4
5	Godfrey & Harrow	57.0	5.8	11.3	0.27	8.7	1.8	0.67	12.3	0.47	0.06	2.0	100.4
6	Bannatyne & Princess	65.7	8.0	8.1	0.29	4.9	2.5	0.57	4.1	1.60	0.08	4.1	100.0
7	Transcona Main (C.P.R.)	51.9	4.8	9.6	0.48	11.1	2.8	0.57	16.3	0.23	0.04	3.1	100.8
8	Broadway & Kennedy	59.2	6.3	11.1	0.30	5.7	3.3	0.95	5.5	3.60	0.05	3.8	99.8
9	Stock Yards	55.8	3.5	10.4	0.21	10.0	3.2	0.50	12.9	0.70	0.07	3.4	100.7
10	Manitoba Gypsum Works	52.4	4.2	10.6	0.25	9.8	3.3	0.45	14.1	1.80	0.10	3.3	100.4

Electric Battery Effect of a Cell Consisting of Two Cast Iron Electrodes in Contact with Two Different Soils

Two cells were so constructed as to provide two pieces of cast iron not in contact with each other, but both in contact with moist soils. the anode being in contact with limy silt and the cathode in contact with a clay soil, both soils being kept moist. One of these cells had an initial e.m.f. of 2.1 millivolts and the other 9.2 millivolts, which latter became 7.6 millivolts when filled with distilled water. Within the first three hours No. 1 rose 10 millivolts and No. 2 rose 40 millivolts. In about 3 days No. 1 had reached 14 millivolts, and No. 2 ,63 millivolts, which were reduced respectively to 12 and to 48 millivolts after adding more water. The voltages varied for two months, alternately rising and falling. At the end of about two months, the cells having stood on open circuit, and without any addition of water, the polarity showed a reversal in both cells. Upon adding water once more, No. 1 recovered its original polarity and voltage, but No. 2 increased its negative polarity to 64 millivolts negative, while No. 1 went as high as 66 millivolts positive.

These results show that soils of Winnipeg and vicinity when in contact with iron, can of themselves set up an appreciable e.m.f. like that of a primary battery, amply sufficient to decompose the iron.

Corrosion of the Cast Iron Water Mains at Selkirk and Transcona

As this case of self-corrosion was outlined in a communication by the writer in *The Journal* for July, 1921, only a few supplemental remarks will be made here.

The soil around the pipe was a limy clay silt, and though it was not as heavily charged with soluble salts (see Table "G") as the Winnipeg soils, crystals of calcium sulphate were found in the soil adjacent to the pipe. There were many limestone pebbles in the soil, more or less decomposed.

The tarry covering of the pipe was peeling off and gave no protection. The corrosion was widespread, but more pronounced on the flanges of the bells which in one instance could be whittled off ¼″ on the edge of the flange. The softening was in patches. At one spot where a limestone pebble was in contact with the pipe the deepest pitting was observed, the pipe being softened about ¼″ deep. The soft areas on the pipe were marked by patches of rust, on removing which the iron could be dug into with a knife blade. Analysis of the corroded material has been given in Table "C". The pipe has been in the ground for about 8 years. It is located about 1¼ miles west of the Northern extremity of the trolley line that runs to Winnipeg, the nearest substation being about 5¼ miles south of Selkirk. The town water works of Selkirk are not connected to the hospital water pipe system, being fully ½ mile distant. A delicate galvanometer has failed to betray the presence of stray current.

Besides the corrosion at Selkirk, we also found well advanced corrosion on a 12 inch. water main at the C.P.R. yard at North Transcona, 3 miles in an air line from the nearest electric railway tracks.

Soil Action on Lead and Copper

Lead and copper are also affected by self-corrosion in these same soils, but our researches have not continued long enough to submit much information. A lead water service pipe in the Selkirk Mental Hospital grounds was found to be corroded and the evidence of decayed manure in the original backfilling of the pipe trench, led us to suspect that nitrates may have hastened corrosion, the other soil salts being much the same as in the case of the corroded cast iron pipe.

To review briefly one experiment, a small new lead plate was buried in contact with a clay soil and some black surface soil in a sealed glass container, with plenty of moisture present, and when removed at the end of 4½ months was found to be pitted with little cavities about as big as pin heads, which were filled with white pellets of crystallized lead sulphate. No heat was applied during the experiment.

A copper ground plate buried below the basement floor of the Manitoba Government Telephone Exchange in St. Boniface, corroded in 18 months or less after installation. We were given to understand by the Telephone people that it would not be possible for any stray current to be leaking out into the earth from the telephone system through this ground plate. We subsequently immersed some thin sheets of copper in neutral solutions of the alkaline salts above mentioned and observed evidence of chemical attack within 24 hours, by the formation in the solution of insoluble greenish compounds of copper.

Corroboration from other Places

The small amount of laboratory research work on self-corrosion of metals in soils, hitherto performed in the United States has not been widely published, and has moreover been so heavily overshadowed by investigations of stray current electrolysis and its mitigation, that self-corrosion is still regarded there more as an occasional accident, than as being inevitable with certain soil conditions. Confirmation of our own findings has therefore been sought and found in reports from the field, rather than the laboratory.

In St. Paul and Minneapolis considerable soil corrosion was found and reported by E. H. Scofield, power engineer of the Twin City Rapid Transit Company in the Electric Railway Journal of November 14th, 1914. There are frequent peat formations where the soil is acid, and in other areas there are nitrates and magnesium chloride. The acid soils pit the iron clean through. Mr. Scofield also reported on a piece of 4″ cast iron water main buried for 20 years at Pierre, South Dakota, and finally removed, after perforation by spongy graphitic pitting, although there never was an electric railway in that town. The products of corrosion from this piece of pipe were found to be of the same character as that taken from the Winnipeg mains, even to the sulphide. In the Minneapolis research experiments, a potential difference as high as 400 millivolts was found between metal electrodes buried in two different soils in the same cell.

At Brandon, Manitoba, a 6″ cast iron water pipe was corroded through before the electric railway was ever installed, and several similar cases are reported as having happened in Calgary before the installation of the electric lines in that city.

A steel pipe line at Rochester, N.Y., some 28 miles long, suffered severely from self-corrosion after lying in wet clay soil or in swamp water for about 7 years. An exhaustive report upon it by John F. Skinner, principal assistant engineer of the City of Rochester has been printed. In this case stray current was diligently sought for to account for the corrosion, but none could be found. Mr. Skinner's report includes a remarkable electro-chemical study of this case, by Richard H. Gaines, chemist of the Board of Water Supply of New York City which was read as a paper before the American Electro-Chemical Society as long ago as 1908.

The more rapid corrosion of steel, than of either cast or wrought iron, is attributed by some authorities to the manganese in the steel, which has a higher solution pressure than the iron and probably dissolves first.

At Portland, Oregon, a similar steel conduit was badly corroded where laid in wet clay, but where it was imbedded in the sandy bottom of a river it remained in good condition.

Remarkable confirmation of our research appeared in the translation of a German article by P. Medinger describing the corrosion of cast iron water pipes at Esch, in Luxembourg. Here the pipes were in a soil full of calcium sulphate and no stray current was present. The soil conditions, and the products of corrosion, were almost identical with those of Winnipeg and vicinity. Mr. Medinger's researches, which covered a period of two years, confirm the fact that the self-corrosion of cast iron pipe is inevitable under the soil conditions which we know exist in the Red River valley.

Preventive Treatment

The subject is so new, that there has not been time to explore methods of inhibiting self corrosion of metals. Evidently the field is as wide open as it is for the protection of concrete.

Although the usual treatments with tar, dips and paints have been generally proved futile, the Rochester Waterworks engineers have confidence in the protection of their newest steel conduit by 3 successive coats of 3 different special paints when applied under very rigid specifications. If these really protect steel, they might also protect cast iron.

We believe that the life of cast iron pipe in a wet salty soil could be lengthened considerably by backfilling the pipe trench with quartz sand or washed gravel, rather than by depending on a thin layer of paint. Although such a backfilling cannot prevent access of salt solutions, it will certainly cause them to be less concentrated, by the time they reach the pipe, and will give atmospheric oxygen better access to the pipe, forming a thin coating of ferric oxide. Some authorities believe this makes the solution of the iron proceed much slower, than when access of oxygen to the pipe is sealed off by a jacket of wet clay.

E. L. C. Forster, chemist on the Dominion Health Board staff, has advised us that a very small percentage of aluminum with cast iron has prevented microscopic shrinkage cracks in the surface of castings that otherwise formed when the casting cooled, and that this property was utilized in making munitions during the war. The absence of minute surface cracks might render the silicious coating of cast iron pipe more impervious to salt solutions. Any method of casting pipe which could produce a flawless exterior coating of silicate, that would resemble enamel, would certainly retard the solution of the iron.

A steel conduit at New Bedford, Mass., where it passed through 2 miles of peaty swamp, was backfilled with gravel and suffered no trouble from corrosion up to the time it was examined after having been in use for 10 years.

In most sections of the Western United States where there are alkaline salts, the soils are so generally porous as not to hold water in contact with buried pipes, and no conspicuous cases of corrosion under such circumstances have come to our notice. Everything seems to point to the desirability of imbedding buried pipes in silicate sand or gravel whenever possible.*

We have also recently learned that high efficiency is claimed in Europe for the Mannesmann special method of protecting with asphalt and jute, steel pipes in contact with corrosive soils or exposed to sea-water.

The foregoing expedients are all that we can offer at the moment, but we trust they may prove suggestive to the engineers most interested.

In conclusion, we desire to point out that the foregoing memoranda are not intended to convey the impression that stray current corrosion does not happen in any moist soil, where the pipes are actually found to be electrically positive to other buried conductors connected with a railway power station bus bar; but we think we have demonstrated that where there is no stray current possible, or where stray current may be flowing *into* a pipe and not out of it, a wet clay soil charged with alkaline salts must inevitably and automatically corrode a cast ron pipe.

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* (Journal fur Gasbeleuchtung und verwandte Beleuchtungsarten so wie fur Massersorgung, Berlin, Feb. 16 and 23, 1918.)

Water Supply and Irrigation Schemes of the Prairie Provinces

History of development, formation, ownership and control of irrigation districts

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Paper presented at the Tenth General Professional Meeting, Saskatoon, August 11th, 1921.

Agriculture is one of the oldest arts known to man and it is probable that irrigation ranks next in age.

It is common knowledge to-day that the Egyptians, Babylonians, Assyrians and other ancient nations which had reached a high state of civilization, applied water artificially to their crops for the purpose of increasing their yield, but it is not so generally known that this art was practised successfully on this side of the world by an ancient race whom we sometimes think of as savages. One of the largest sugar estates in the world is to-day irrigated by a system, the main canals of which are the irrigation ditches constructed thousands of years ago by the Incas of Peru, or their predecessors, for watering their crops. It was only necessary for the present owners to clean out the accumulated debris of several thousand years and turn in the water.

The necessity for the artificial application of water to crops is readily recognized in those areas where the rainfall is insufficient to produce a profitable crop, but the desirability of irrigation for the purpose of increasing an already good crop to the maximum yield is not so often realized. In general it may be said that wherever the rainfall is 10″ or less during the cropping season and so distributed as to cause droughts of 17 days duration or over, irrigation is desirable.

In limited portions of Southern Alberta and Saskatchewan, irrigation is a necessity, that is, the rainfall is insufficient to produce a profitable crop. In the greater part, however, of the area of these two provinces which lies South of township 40, irrigation is desirable for increasing the yield.

The writer does not propose to discuss the benefits to be derived from the application of water in this area except to state that it has been demonstrated that the yield from dry farming may be increased from 50% to 100% by irrigation at a slight additional cost.

History of Irrigation in Alberta

While there were a number of small private irrigation schemes built in this area previously, irrigation on a large dates from the year 1900 in which the Alberta Railway and Irrigation Company's project was completed. This system irrigates about 80,000 acres South and East of Lethbridge, Alberta. The main canal and distributaries were constructed and are maintained and operated by the company, and the farmers own and operate the laterals. Their source of supply is the St. Mary River. The Canadian Pacific Railway Company now owns the controlling interest in this company.

In 1910 another block of land known as the "Western Section" was brought under irrigation by the Canadian Pacific Railway Company. This land is located just East of Calgary and contains about 223,000 acres of irrigable land. Its source of supply is the Bow River. The main canal, distributaries and laterals were all constructed by the company and water is delivered by them to each quarter section. The cost of this system was approximately $22.00 per acre.

Three years later in 1913, the same company completed the Eastern Section Irrigation Project at a cost of about $26.00 per acre. This contains about 400,000 acres irrigable and extends from the Bow River to the Red Deer River in ranges 11 to 16 West of the 4th Meridian. The source of supply is also the Bow River.

The company charges a maintenance fee of 50 cents per acre in the Western Section and $1.25 per acre in the Eastern Section and $150.00 per second foot of water furnished in the A.R. & I. Tract, which equals 75 cents per acre under present duty or $1.00 under old duty.

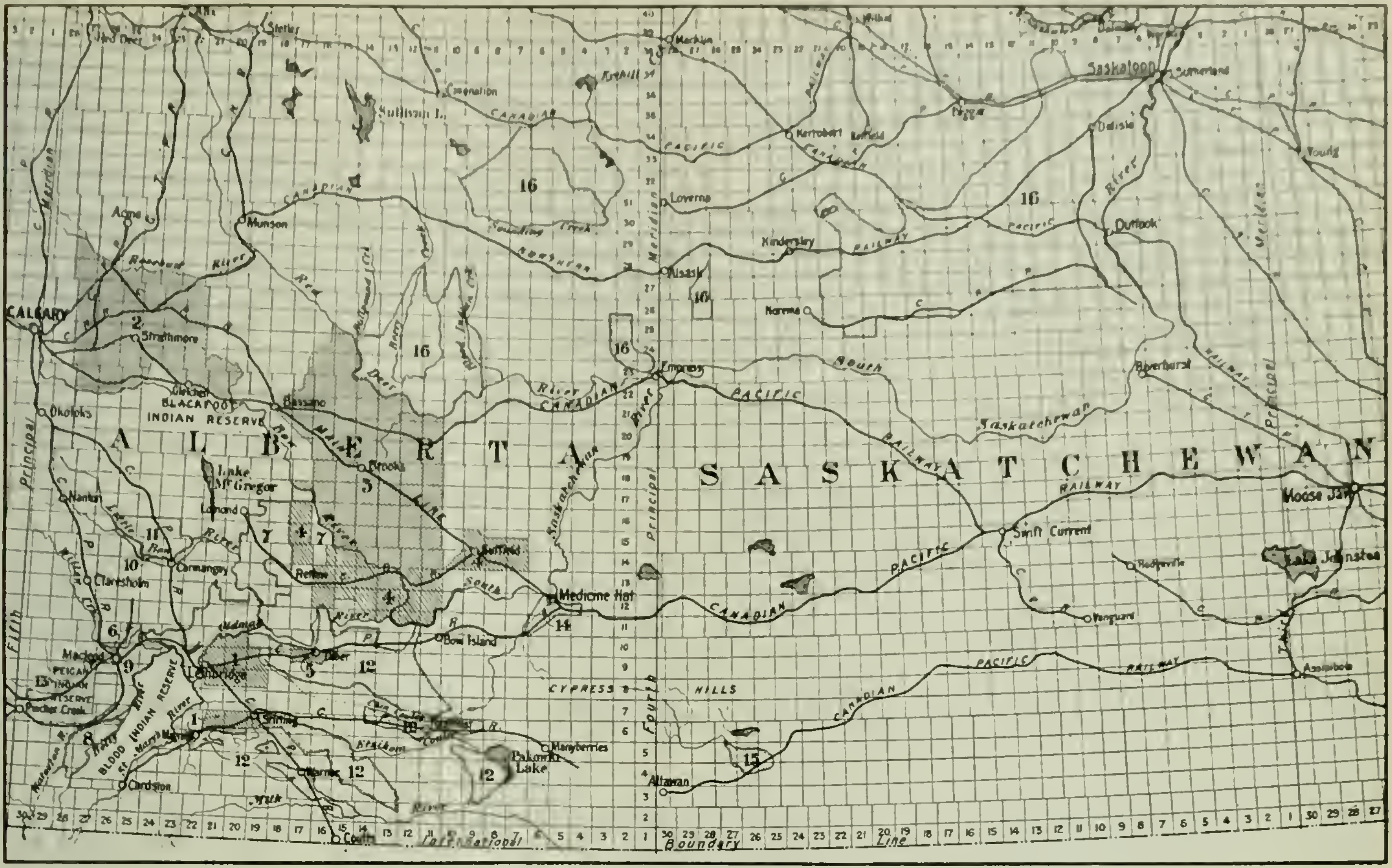
In 1920 the Canada Land and Irrigation Company delivered water to its land for the first time. When this system is completed it will serve about 200,000 acres. Its source of supply is also the Bow River. The annual charge for maintenance under this system is $1.50 per acre.

These projects have all been developed by corporate interests for the purpose of irrigating their own lands, and as this area was not settled previous to construction, colonization was and is still an important part of these schemes.

The A. R. and I. and Western are practically all sold. The Eastern Section, however, is now settling up fast, having been retarded somewhat by the war.

The Canada Land and Irrigation Company, however, have only about 10,000 acres under cultivation this year.

Those interested in irrigation realized that there were certain areas already settled up which needed water, but owing to the fact that this land was owned by the settlers, there was not the same incentive for corporate interests to develop an irrigation system to serve it, because the profits from these operations were largely in the sale of the land and not in the carriage of water. The demand therefore arose for some means by which the settlers could co-operate in the construction of a system to irrigate their own lands.



Map of Southern Alberta and Saskatchewan showing the Irrigation Projects.

In operation; 1.- C. P. R. Lethbridge Section formerly A. R. & I. Co., 80,000 acres ; 2.- C. P. R. Western Section, 223,000 acres : 3.- C. P. R. Eastern Section, 400,000 acres ; 4.- Canada Land & Irrigation Co. Project, 200,000 acres ; 5.- Taber Irrigation District, 17,000 acres. Under construction: 6.- Lethbridge Northern Irrigation District, 105,000 acres. Proposed: 7.-Retlaw-Lomond Project, * 70,000 acres ; 8.- United Irrigation District, 23,000 acres ; 9.- South MacLeod Irrigation District, 60,000 acres ; 10.- Little Bow Irrigation District, 3,000 acres ; 11.- Champion Irrigation District, * 50,000 acres ; 12.- Lethbridge Southeastern Project, 500,000 acres ; 13.- Beaver Creek Irrigation Project, * 10,000 acres ; 14.- Medicine Hat Southern and Eastern Project, * 10,000 acres ; 15.- Cypress Lake Irrigation Project, 12,000 acres ; 16.- North Saskatchewan Project (not surveyed), Unknown. (* Surveys not completed).

Irrigation Districts

When the Province of Alberta was created it fell heir to an irrigation districts act, which appeared to be the proper means through which to accomplish this purpose. As provisions of this act were, however, out of date and unsatisfactory in other respects, the Alberta Government was, in 1915, prevailed upon to repeal this act and pass a new Irrigation Districts Act adequate to meet the present conditions.

The first group of settlers to take advantage of this law were those in the vicinity of Taber, Alberta, who organized the Taber Irrigation District, issued bonds and contracted with the Canadian Pacific Railway Company to extend the works of the Alberta Railway and Irrigation project to cover 17,000 acres of their land, for which the company took their bonds at par as compensation. This system cost the district about $16.00 per acre. Water was delivered to this area for the first time this year. The district owns and operates the system, the company simply delivering the water at the head of their main canal.

The Lethbridge Northern Irrigation District was the second to organize under this law (November 1919). This district has voted $5,400,000.00 for the construction of its system which is now under way and is to be completed by May 1923. This sum, however, provides for three years interest and one year's maintenance of the works that is, the farmers will have no interest or maintenance to pay until one year after the completion of the works. This district contains about 105,000 acres of irrigable land. The estimated cost of the works is about $51.00 per acre. Owing to this estimate being made during high prices prevailing during 1919 it is probable that it will be built for less than this amount.

The United Irrigation District has organized and is about to issue bonds for the construction of a system to cover 23,000 acres lying between the Belly and Waterton Rivers, at a cost of about $28.00 per acre.

Districts in Formation

Several other districts are in various stages of formation: the South Macleod Irrigation District of 60,000 acres, the Retlaw-Lomond Project, covering 70,000 acres, the Medicine Hat Southern and Eastern Projects, 10,000 acres, the Beaver Creek Project, 10,000 acres, the Champion Project, 50,000 acres, the little Bow Project, 3,000 acres, the Lethbridge Southeastern Project, 500,000 acres, the North Saskatchewan Project, acreage unknown, the Cypress Lake Project, 12,000 acres,

This gives a total, exclusive of the last two projects, which lie almost entirely in Saskatchewan, of 1,751,000 acres which it is proposed to irrigate in Alberta.

The source of water supply for this is to be drawn from the tributaries of the South Saskatchewan River in Alberta and it has been suggested that this might so deplete the supply in this river as to interfere with the proper development of the Province of Saskatchewan. While the provincial officials have no control over this matter, the allocation of water being entirely in the hands of the Minister of the Interior, a hasty study of the situation indicates that this is not the case. Assuming that all the land mentioned above will ultimately be under irrigation, and an irrigation factor of 80%, we have 1,400,800 acres net to be irrigated in any one year. Under the present duty of water of 1½ acre feet per acre, this would require 2,101,200 acre feet net. Assuming 50% losses, we have 3,151,800 acre feet gross as the necessary quantity of water required to irrigate this land. The records of the run-off for the South Saskatchewan River for the years 1911 to 1919 inclusive, at Medicine Hat, located below all these projects, show that there passed during each year into Saskatchewan from 700,000 to 6,000,000 acre feet in excess of this amount. For the year ending August 1919, 684,000 acre feet more than enough to irrigate these lands passed by Medicine Hat in Saskatchewan. During this same year the larger projects diverted approximately 500,000 acre feet from this flow which should be deducted from the quantity required to supply this total area and added to the quantity available for use in Saskatchewan making over 1,000,000 acre feet excess above the requirements for irrigation of this land in Alberta during the dryest year on record.

This, of course, assumes that proper storage facilities are provided to make this water available.

Sources of Supply

An additional factor of safety is found in the fact that the intakes of the larger projects, whose sources of supply are from the Old Man River and its tributaries, are located well up on the streams, leaving a large territory below tributary to these rivers, the drainage from which will pass into Saskatchewan. This is made up of the natural run-off and the waste and percolation from the large irrigated tracts.

Further comparing the run-off of the South Saskatchewan at Medicine Hat with the run-off at Saskatoon, we find that during the months of heaviest draft on the supply, viz: June, July and August, there is a gain in the quantity of water flowing between these points varying from about 2000 to 20,000 acre feet per month. In this connection it should further be noted that the banks of the South Saskatchewan from Medicine Hat to Saskatoon are so high that the use of water from this source for irrigation of any large tract is practically prohibitive. Pumping for the irrigation of general agricultural crops is not successful in this area to a height of over 40 feet using gasoline or coal for fuel. This might be increased to 100 feet if natural gas was available for fuel. There is, however, another source proposed for this purpose which cannot be used to any great extent in Alberta. This source is the North Saskatchewan River and can probably be developed to supply close to a million acres in Saskatchewan. Preliminary surveys for the use of this water are now in progress by the Reclamation Service. The only demands on this water of the South Saskatchewan would therefore probably be limited to domestic and municipal uses. The requirements of the district now organized to supply Moose Jaw, Regina etc., is about 1500 a.f. per month.

It will therefore appear from this hasty view of the situation that there is sufficient water in the South Saskatchewan River and tributaries to supply all the demands of both provinces.

Irrigation Districts Act

As reference has been made in this paper to the Irrigation Districts Act, under which future irrigation development in that Province will proceed and as the Province of Saskatchewan passed a similar Act in 1920 a short resumé of the statute as reenacted in 1920 will be given and those desiring further information are referred to the excellent paper on the Act read by H. B. Muckleston, M.E.I.C. at the Banff meeting last year, (*Journal* page 510, November, 1920.)

As many are aware, the Dominion Reclamation Service makes all preliminary surveys and investigates as to the feasibility of the projects. When these are completed and the boundaries of the irrigation area are fixed, the Act provides that a petition signed by the owners of at least 51% of the area involved shall be submitted to the minister of public works of the province. After proper advertisement of the fact an election is held at which a board of three trustees is elected to run the affairs of the district. The district is a corporate body somewhat similar to a municipality. The trustees have the necessary powers to buy and sell real-estate, construct, maintain and operate irrigation works and raise funds for this purpose by issuing debentures and taxing of the land in the district. Under the amendments of 1921 all arrears of taxes are collected under the provisions of the Tax Recovery Act of the province.

The Act also provides for an Irrigation Council of not to exceed three members, whose duty it is to advise the trustees concerning the conduct of the business of the district. The members of this body are appointed by the Lieutenant Governor in Council. At present there are two members, L. C. Charlesworth, M.E.I.C., deputy minister of railway and telephones of Alberta, and the writer. This council may forbid any act or course of conduct proposed to be done or entered into by the Board. No money received by a district on a Bond issue shall be expended without its approval. It may employ such advice and assistance as may be necessary, the cost to be charged against the district in connection with which the work is done. No construction work shall be begun or contract let for the same until approved by the council. The annual assessment fixed for operation and maintenance by the trustees must be approved by the council.

The Alberta Government has adopted a policy of guaranteeing the principle and interest of the debentures of irrigation districts. Before this is done, however an engineer is employed to make a special report on the project and each case is dealt with on its merits. If the engineer's report is favourable, a special act may be passed by the legislature guaranteeing the bonds.

In the case of the Lethbridge Northern Irrigation District this special act also imposed upon the Irrigation Council the additional responsibility of taking all steps preparatory to the construction of or letting contracts for the construction of any works and it is assumed that this will be the usual provision where the Government guarantees the bonds.

Ownership by Settlers

As has been intimated before, the large irrigation systems now in operation in Aberta are owned and operated by private corporations. In the United States this stage of corporate ownership and carriage of water for hire has passed and the farmers have bonded their land and purchased the works of these companies. In British Columbia they are in the transition stage, the government having provided a fund from which communities wishing to get control of their works can borrow the necessary money.

In Alberta no desire has been shown as yet by the settlers under the large projects to acquire their systems but it may be reasonably expected that this situation will arise later and it may be noted in passing that the Irrigation Districts Act of Alberta provides a means for this purpose.

Alberta has another Act known as the Water Users' Districts Act. This provides a means whereby all the users of water under one or several laterals or distributaries in any system may form a co-operative association for the operation and maintenance of the particular part of the system under which they farm. They are governed by a board of three managers who have power to tax the land for acquiring funds to carry on the work of the district. Several of these districts have been formed under the A.R. and I. system and are operating with more or less success.

Irrigation in Southern Alberta cannot proceed much further until a decision has been rendered by the International Joint Commission as to the meaning of the Treaty dividing the waters of the Milk River and St. Mary River between the United States and Canada, as the proposed Lethbridge South Eastern Project depends largely on these streams as a source of supply.

Irrigation has only just started in the prairie provinces, and if the schemes now projected proceed to completion and are operated successfully, Southern Alberta and Saskatchewan will be the garden spot of the Dominion.

Economics and Engineering Features of the Manitoba Power Commission

General considerations, features of the Portage Line, later developments

J. Rocchetti, M.E.I.C., Chief Engineer, Manitoba Power Commission.

Paper presented at the Tenth General Professional Meeting, Saskatoon, August 11th, 1921.

Coal, water and oil are the chief sources of power, and the first consideration to be taken into account is to determine the best method of delivering this energy—once it is developed, to the points of use.

When the chemical energy of coal or oil, or the mechanical energy of water falls is converted into electric energy, a transmission line will carry this energy to the actual point of use. It is brought into a factory, street or home and there converted into heat, light or mechanical energy, as the case may be, and this may be done under the most perfect control and handled with very little labour. No other form of energy may be so conveniently used as electrical energy.

The time is not far distant when a network of interconnected transmission lines will supply all the energy required for the factories or for our homes. The recognition of this fact is the cause of the development of so many devices and so much apparatus to assure continuity of service. At present the transmission of power is still in the preliminary stage. Future transmission developments will constitute the backbone of a new era of industrial civilization, and to reach this the requirements may be enumerated as follows:

1. Reliability of supply.
2. Avoidance of abnormal conditions on transmission line which may injure the user's apparatus.
3. Constant potential and frequency.
4. Flexibility of the system.

True engineering is essentially an economic science, and all transmission problems are to be based on general economic principles. The real difficulty in designing a transmission system is in estimating not only the present requirements but the probable future demand from the same system.

Features of High Tension Systems

On this continent the actual practice is to transmit electrical energy by means of three-phase alternating current, with frequency of 25 or 60 cycles, the latter periodicity being more or less standard at present. Another system of transmission of energy is by means of high tension direct current, a system developed by Thury and quite extensively used in Europe.

Considering only overhead construction, conductors may be supported by wood, steel or reinforced concrete structures. Wood supports may consist of single poles or composite frames. Steel structures may be tubular poles, latticed poles, flexible towers or heavy rigid towers with wide rectangular base. The type of supporting structures will be dependent upon the span or distance between supports. One of the most important economic questions is the determination of the standard span. The material of the conductors, the cost of the supports, insulators, etc., and the consideration of maintenance cost will determine the length of the span.

The most economical size of conductors for a given amount of power to be transmitted may be fouud applying Kelvin's Law, and also for the economic ohmic voltage drop. Next to consider is the economic voltage which is the most important matter of all. A very important consideration to bear in mind is that more trouble may be experienced in handling heavy current than in handling high voltages.

The transmission of energy by high voltage has progressed very steadily since the first 100,000 volt lines were built in 1906-09. The range of voltage has extended upward and at the present date 150,000 volt lines are in active operation, and soon a 220,000 volt superpower line will be under construction.

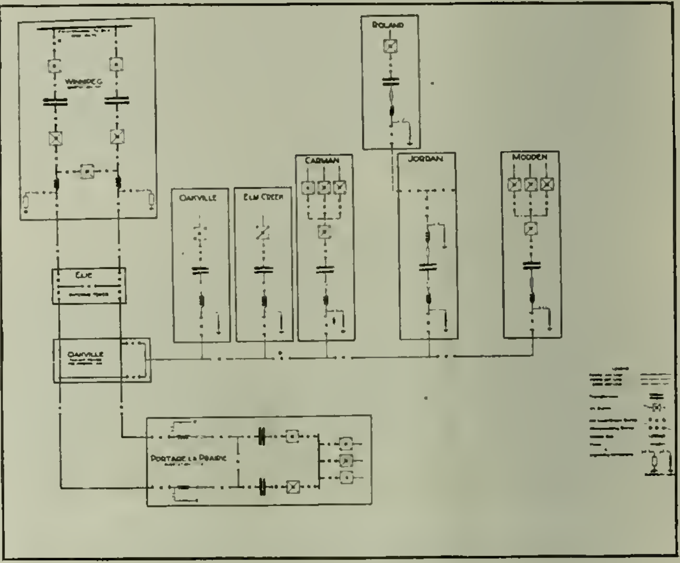
The distance which the energy must be carried and the amount of power to be transmitted are the factors determining the voltage to be used. The choice of voltage is based on economical considerations resulting from the calculation of line losses and voltage drop, and by practical considerations.

The conductor used is chosen after consideration of losses, mechanical strength and other factors. Up to the present time, the tendency has been to choose a size of conductor which would not produce corona loss at normal operating voltage. The actual practice is that to avoid a too-large size of conductor for the carrying of the power currents a reasonable amount of corona loss is allowed, providing that the combined losses are not economically excessive.

Another important feature of high voltage transmission lines or systems is whether these are to be operated with isolated or grounded neutral. Both systems are in use, and from a list issued by the Electrical World for systems of 70,000 volts and over, they were about equally divided. However, the present tendency for voltages above 100,000 is for direct grounded neutral. Single circuit transmission systems are mostly operated with isolated ground, but in a transmission system, where there are so many variable factors, and is governed mostly by local conditions, experience is more valuable than theory, and so this question is solved in practice as for many another problem met in transmission of power.

Manitoba Power Commission

Since the establishment of the Manitoba Power Commission by order-in-council in July ,1919, under the authority of the Electric Transmission Act, which was passed in the Legislative Session of 1919, considerable progress has been made toward ultimately supplying all the more densely populated sections of the province with an adequate supply of electrical energy from hydro-electric or other sources. The first undertaking has been to supply adequate electric power to the city of Portage la Prairie.



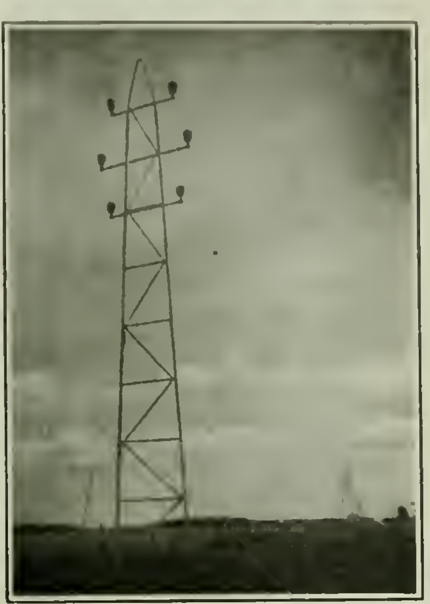
System Layout.

Winnipeg—Portage Line

After considerable preliminary work in connection with the most economical supply, it was decided that the best solution was to build a transmission line from Winnipeg to Portage, energy being supplied from the Winnipeg hydro system. Consequently, a survey was made and the final location of this transmission line was mapped. To reduce the cost at a minimum considering that all charges were to be borne by the city of Portage la Prairie, it was decided to run the line along country roads, so as to avoid having to buy a right of-way. This line starts at the City of Winnipeg's substation located at the corner of Stafford St. & Scotland Ave. and ends at Portage la Prairie city limits, the receiving substation being located on Saskatchewan Avenue. After careful consideration of relative cost of wooden and steel supports and of the amount of money allocated to this undertaking it was decided that the latter would be the more economical and, consequently, the line was built with galvanized steel structures, with steel foundations. The standard span, after due consideration to the voltage used, insulators, conductors, sags, etc., was fixed at 500 feet, reducing it to 400 feet inside the limits of Winnipeg.

The voltage used, 66,000 volts, was decided upon after due consideration of the length of the line, nearly 60 miles, the relative cost of pin and suspension insulators, the cost of the steel supports, and in considering that this line was intended only to supply Portage la Prairie.

The general design of the line consists of three spans supported by A frame flexible towers, the next span being supported by a square tower. About every mile there is an anchor tower to which conductors are dead ended Inside the city limits, special narrow latticed poles are used with solid concrete foundation.



Portage Line—Standard Flexible A Frame.

Special towers are used for railway crossings, corners and crossings over telephone or power lines. The steel towers were designed to carry two three-phase circuits and a ground wire at the top. Aluminum cables steel reinforced of No. 1/0 size are used. The ground wire is of Martin Siemens steel cable ⅜ inch in diameter. The size of conductors was selected for a carrying capacity of 5000 K.W. for each one of the three-phase circuits.

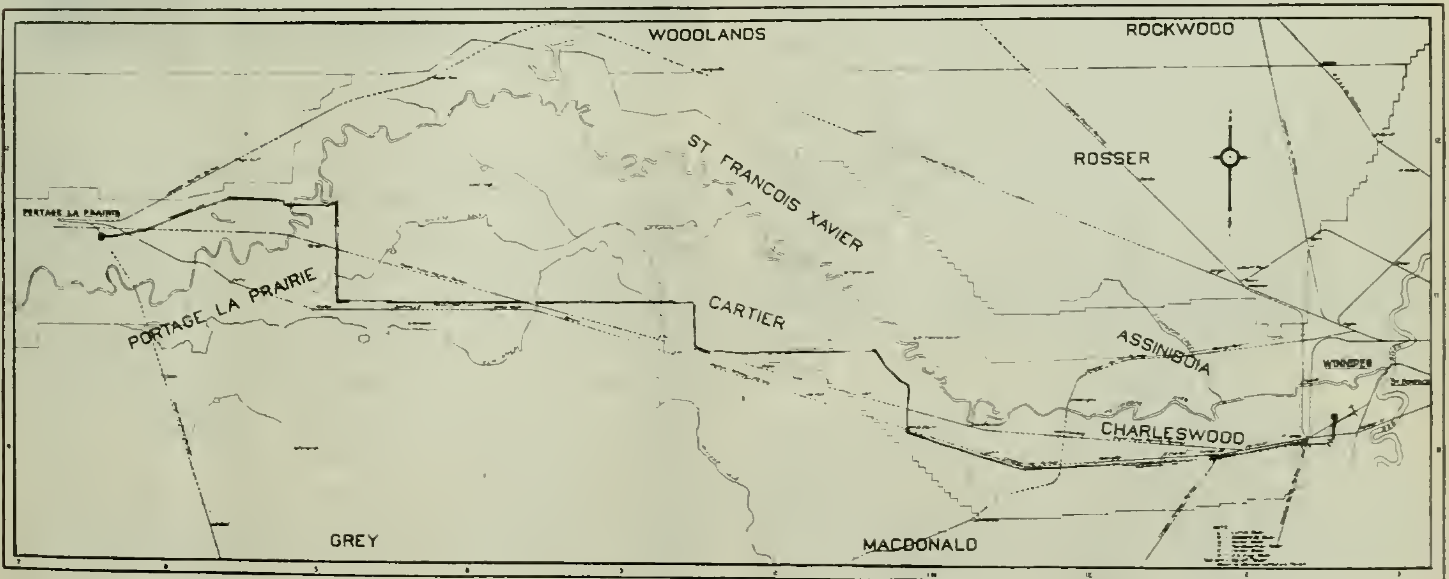
The insulation of the line was very carefully studied. Pin insulators, distributing electrostatic stresses evenly throughout the insulator body were selected thus ensuring operating reliability and greater durability of the insulator. The wet and dry tests, made as per specifications, showed a very high factor of safety. Suspended insulators, composed of a string of five discs, are used for anchoring. All railway crossings have been constructed in accordance with the rules of the Board of Railway Commissioners.

Special care was taken for a very efficient and protective tie of the conductor to the insulator, and the tie used proved to be very good. Conductors were strung in accordance with prepared sag charts.

In consideration of the fact that the municipal steam plant supplying power and light at Portage la Prairie was in a very precarious condition and liable to be out of service at any time and furthermore unable to supply the demand, the commission was asked to hurry the construction of the power line, and although it was admitted that work of the kind could not properly be done in winter time in the prairie, still the work went on with the understanding that they were taking the responsibility of the stability of the line.

The construction was almost completed when in the middle of March, 1920, a sleet storm with wind at 60 miles, raged over the prairie. Ice about 3 inches in diameter had formed around the conductors and the steel covers were covered with ice three and four inches thick. It was on this occasion that the steel foundation failed, this failure being caused by the impossibility to tamp the frozen earth on the footings properly, and by the peculiar clay formation common in the greater part of Manitoba which works like a sponge and cannot be tamped.

As a result of this experience, it was decided to concrete all footings, and since this has been done we have had no more failure of the footings.



Winnipeg—Portage la Prairie Line Route Map.

Portage Line—Three Corner Towers.

As the transmission line parallels the telephone trunk line and railroad telegraph and telephone lines for quite a number of miles, very careful transpositions were made of the conductors, to avoid any interference. With proper insulation and short-length transpositions, trouble was not anticipated, and indeed, since the line has been in operation, no trouble from this source has been experienced.

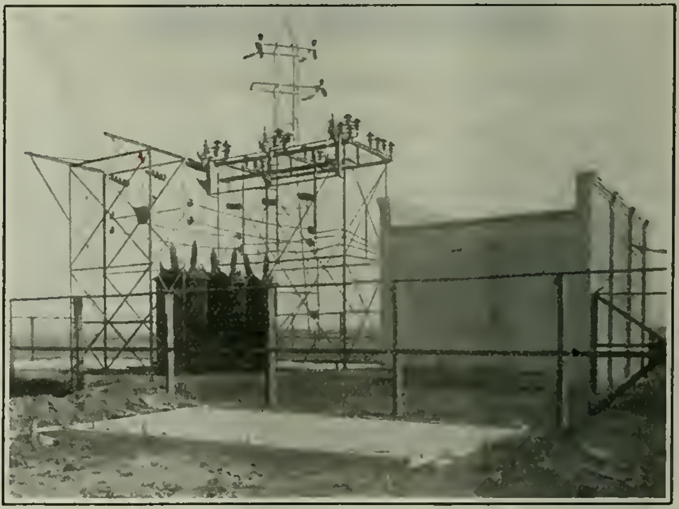
In co-operation with the Manitoba Govt. Telephones, a special telephone service has been installed, parallelling the transmission power system, connecting all substations with the headquarters, and also connecting with the homes of the Commission's patrolmen. While making his daily inspection, the patrolman may hook a portable telephone set anywhere along the line and get any necessary connection.

The city of Portage la Prairie had decided to install its central switchboard at the pump house, so that it would be possible to dismantle the present steam power plant. It was decided not to carry the high tension line through the city streets, and consequently the terminal station was located, as stated, near the city limits, on Saskatchewan Avenue. From this terminal a tie line of low voltage was built to connect with the city's switchboard. This tie line of about seven thousand five hundred feet, is carried on wood poles. Two three-phase line of No. 4/0 copper conductor were used, and more circuits may be added to take care of future power requirements. Sectionalizing switches for testing purposes or for disconnecting faulty sections of the system, and selecting switch towers are installed for transfer purpose.

Supply Station

The electrical energy supplied by Winnipeg Hydro system is delivered at the sub-station at a nominal voltage of twelve thousand volts at sixty cycles. The voltage is stepped up to 66,000 volts by means of two banks of transformers, one with a capacity of 1,500 K. V. A. the other of 3,000 K. V. A. Each circuit of the transmission line is controlled by a 70,000 volt automatic oil circuit breaker and the high tension bus bars are connected through a non-automatic oil breaker. Connections are delta-delta. A full flexibility is realized at the sending station. Protection is afforded by means of electrolytic arresters mounted with impulse gap. The receiving substation at Portage la Prairie is of the outdoor type, as are all other sub-stations installed later by the Power Commission. At present one bank of 1,500 K. V. A. step down transformers is installed there. A steel structure supports the horn gap switches and the protective apparatus. The present bank of transformers may be fed from either circuit.

The line was put in operation in the middle of August 1920, with only one circuit installed. The total cost of the undertaking including the concrete footing is around three hundred and fifty thousand dollars. The cost per mile of a single circuit line without including the sending and receiving station is about five thousand dollars. Although as stated, this line was not designed to become a backbone of a system, the demand for power from several districts compelled us to use it temporarily as a main line.



Portage la Prairie Substation First Unit—66000/22,000 V.

The line to Morden, which supplies Elm Creek, Carman, Roland and Morden, was branched out at Oakville, about 45 miles from Winnipeg. This line is 56 miles long, and of single circuit type, with ground wire. The supports used are of latticed pole type with concrete foundation, specially designed. A peculiarity of this line is the staggering of the insulators. The span used is 425 feet with No. 1 aluminum steel cord cables. Outdoor substations were installed at Carman, Roland and Morden. At Jordan is an outdoor substation stepping down from 66,000 to 22,000 volts. This latter voltage is to feed comparatively short lines, carried on light poles, such as the Bates poles which are used to supply Roland at present. Several lines of this kind have been already mapped out and will be built in the near future. The cost per mile of the Morden line without including the substations is about four thousand four hundred dollars.

Roland Line—22000 V. Bates Expanded Poles

Second circuit on Portage Line

As the system started to extend, it was decided to instal the second circuit on the Portage line. This had to be done without interrupting the service in the system. The work, although of a very dangerous character, has been carried on without the least accident and with as little interruption as possible. To change the transpositions the line had to be made dead, and this work has been done on Sundays, so as not to stop service to power users.

Other Activities

The activity of the Power Commission has not been concentrated only on the construction of power lines. Distributing networks have been erected in Carman, Roland, Morden, Virden and Minnedosa, and all operating features are under the control of the Commission. In Virden and Minnedosa were installed two power plants, with semi-diesel engines. In Minnedosa, the Commission took over the hydro plant of the Minnedosa Power Co. which will be in the near future re-designed and will be operated in parallel with the oil plant. All construction work has been carried by the Commission's own staff.

In the early morning of the 2nd of July this year, a cloudburst raged over the South West part of Manitoba, with wind of cyclonic force.

At that date about two miles of towers failed. To re-establish the service as quickly as possible, a temporary wood line was built, and in less than a week the system was in operation again.

No criticism has been spared as to the design of the Portage line, specially concerning the use of flexible towers. These have been used quite extensively by a great number of power companies, and have been recommended by some of the best authorities in transmission line construction. Others have stated that the whole line was too lightly built and unable to give a reliable service.

Now, in the spring of this year, there raged over the prairie a sleet and wind storm that did no damage whatever to the line, when telephone and telegraph poles were put down for miles and miles.

The towers were designed for six conductors and ground wire using "B" load, or one-half inch ice plus eight pounds wind per square foot at 0°-F. Recently the U. S. Bureau of Standards has recommended three classifications as follows: heavy loading; same as class B B of N.E.L.A.; medium loading ⅔ heavy loading; light loading $^{4}/_{9}$ of heavy loading.

The flexible towers were designed for a normal load, applied at middle cross arm of 3,000 pounds and the square towers were designed for a breast pull applied at the same point of 3,500 pounds. To satisfy ourselves after the wreck occurred, a full field test was made with towers standing and under normal conditions, that is to say, with conductors, insulators, etc. and the result of this test is as follows: the first test was made with a flexible tower guyed four ways. This tower failed at the head, member no. 2 buckling, when the reading of the dynamometer reached 1,450 pounds, which in taking the efficiency of the tackle and blocks at 75.2% gives an actual pull of near 7,000 pounds. In the second test, the failed member was replaced and all guys removed, then the load applied. The footings began to fail when under a load of 3,280 pounds. The tower failed when the load reached 5,482 pounds, caused by the footings on the tension side being pulled out about half a foot. We have to consider that this tower had been overstressed on the previous test. The third test was made with a standard square tower without conductors or ground wire. The footings on the tension side started to pull when a load of 6,705 pounds had been applied. At 7,100 pounds the tower did not show any deformation whatever, and the test stopped, because the tower would have been destroyed through failure of footings.

The tests showed conclusively that the towers were properly designed, and only an overload of magnitude which was impossible to be considered, had been the cause of the wreck. The tests were witnessed by several interested people, and very carefully made.

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Committee on Deterioration of Concrete in Alkali Soils

At the special meeting of Council held in Saskatoon on August 12th, members of *The Institute's* Committee on the Action of Alkali Soils on Concrete reported that this Committee had on hand thirteen thousand, two hundred dollars and the Committee desired to make a contract with Professor Thorvaldson to carry on the chemical work of the Committee for a period of three years, and that all results, observations or discoveries from this work should be the property of *The Engineering Institute of Canada.*

On motion by Geo. W. Craig, M.E.I.C., seconded by W. M. Scott, M.E.I.C. and carried unanimously it was resolved:

> "That **The Engineering Institute of Canada** enter into an agreement with Professor Thorvaldson to retain his services and carry on the chemical work of **The Institute's** Committee on the Deterioration of Concrete in Alkali Soils and secure his services for a period of one year, being paid from the funds now in the hands of the Committee, and that **The Institute** be asked for a continuation of such contract with Professor Thorvaldson for a further period of two years, all results to be the property of **The Engineering Institute** of Canada."

The action of the special meeting of Council was further confirmed at the regular meeting of Council held on September twentieth. The members of the Committee on the Deterioration of Concrete in Alkali Soils deserve great credit for the splendid manner in which they have organized the work of this Committee and for the progress made since the Committee's inception. It is hoped that the Annual Meeting will endorse the contract with Professor Thorvaldson for an additional two years, in which time it is expected that definite results will be secured leading to a solution of the problem to the lasting benefit of mankind in general and both to the credit and advantage of the engineering profession.

Roads and Pavements Committee

The personnel of the Roads and Pavements Committee of the Council was endorsed at the last meeting under the chairmanship of W. A. McLean, M.E.I.C., deputy minister, Department of Public Highways, Ontario., as follows; W. P. Brereton M.E.I.C., city engineer, Winnipeg, Man.; F. W. W. Doane, M.E.I.C., city engineer, Halifax, N.S.; E. A. James, M.E.I.C., Toronto and York Highway Commission, Toronto; J. A. Duchastel, M.E.I.C., city manager, Outremont, Que.; J. E. Griffith, M.E.I.C., deputy minister of public works, British Columbia; G. Henry, A.M.E.I.C., chief engineer, Department of Public Roads, Quebec; A. F. Macallum, M.E.I.C., commissioner of Works, Ottawa; Lt. Col. A. J. McPherson, A.M.E.I.C., Regina, Sask.; W. P. Near, M.E.I.C., city engineer, St. Catharines, Ont.; P. E. Mercier, M.E.I.C., Montreal; G. G. Powell, M.E.I.C., Department of Works, Toronto; C. H. Rust, M.E.I.C., Toronto; H. S. Carpenter, A.M.E.I.C., deputy minister, Department of Public Works; B. M. Hill, M.E.I.C., road engineer, Public Highways, Saskatchewan; Alexander Macgillivray, A.M.E.I.C, commissioner of highways, Manitoba; L. C. Charlesworth, M.E.I.C., deputy minister of public works, Alberta; Patrick Philip, A.M.E.I.C., chief engineer, Department of Public Works, British Columbia; W. A. Hendry, A.M.E.I.C., chief engineer, Highway Board, Nova Scotia; the committee has its work well in hand so that definite results may be expected in the near future.

Town Planning Conference

An interesting congress took place at the Place Viger Hotel, Montreal on September twenty-ninth, thirtieth, and October first in the nature of a Montreal Town Planning Convention and Exibition under the joint auspices of The Town Planning Institute of Canada and the City Improvement League of Montreal. The Council of *The Institute* recognized the importance of the gathering by extending the courtesies of headquarters to the assembled delegates.

The important part played by members of *The Institute* in presenting papers is shown by the programme, as the great majority of addresses were given by corporate members. Among the papers presented were:" The Principal Thoroughfares of Montreal" by G. R. MacLeod, M.E.I.C., "The Automobile and Urban development" by J. A. Duchastel, M.E.I.C., "Subterranean Electric Conduits" by Prof. L. A. Herdt, M.E.I.C., "Common Transport and the Development of Modern Cities", by Paul Seurot, M.E.I.C., "Congestion in Cities" by Aimé Cousineau, A.M.E.I.C., "Suburban Development in Montreal" by Leonard E. Schlemn, A.M.E.I.C., "The Tenure of Land and its effects on Town Planning" by H. L. Seymour, A.M.E.I.C., "The Control of Subdivisions" by Malcolm D. Barclay, A.M.E.I.C., "Economics of Organic Planning by Noulan Cauchon, A.M.E.I.C., "City Planning with Special Reference to Surveying by Aeroplane" by Douglas E. Nelles, M.E.I.C.

More Honorary Degrees

In a recent issue of *The Journal*, the Ottawa Branch News, in referring to the granting of honorary degrees to engineers by the University of Toronto, and Queen's University raised the query, "What's the matter with old McGill"? This has been answered by an announcement just made by the President, and Board of Governors of McGill, giving a list of the names of those who are to receive the Honorary Degree of Doctor of Laws on the occasion of a special convocation to be held at the time of the Centenary Reunion. Evidently, McGill was waiting for a suitable opportunity, and no doubt the engineering profession in Canada, will be proud of the fact that the list includes the names of six prominent members of *The Institute* including two Past Presidents.

G. H. DUGGAN, D.Sc., L.L.D., M.E.I.C.

C. V. CORLESS, D. Sc., M.E.I.C.

On the afternoon of Thursday, October the thirteenth, the degree of Doctor of Laws will be conferred upon Past President O. Phelps Johnson, M.E.I.C., Past President, G. H. Duggan, D.Sc., L.L.D., M.E.I.C., Lt. Col. Alexander Macphail, C.M.G., D.S.O., M.E.I.C., Geo. F. Porter M.E.I.C., C.V. Corless, D. Sc., M.E.I.C., and W. W. Colpitts, M.E.I.C.

W. W. COLPITTS, M.E.I.C.

The universities in the Maritime Provinces and in Western Canada are yet to be heard from.

Unemployment Situation

The fact that we are facing an unusual slackness regarding engineering work in general, and construction in particular, means that few positions are available, and a considerable number of engineers are unemployed. To those who are fortunate enough to be well secured in their positions an opportunity is presented of making a special effort to demonstrate that there is a fraternal spirit and a willingness to co-operate among members of the professsion. For instance, letting a man out at the present time is almost equivalent to condemning him to unemployment possibly for several months, for under present circumstances, it is practically impossible for an engineer not employed to secure a position. Would it not, therefore, be well if the engineers who influence engineering positions to make a special effort to hold their men during the coming winter months even though it meant a temporary reduction in pay?

At headquarters not a day passes without several calls from young engineers, and, older men who are not only out of work, but in some cases need employment to maintain existence.

The situation demands that every engineer do his best to assist in the continued employment of other engineers, and in helping these not employed, out of a temporary trying period.

ELECTIONS AND TRANSFERS

On September 20th, 1921, the following admissions and transfers were effected:—

Members

Robert W. Angus, B.A.Sc. (Univ. of Tor.), professor of mech. engr'g., Univ. of Toronto, Toronto, Ont.; Emil Amandus Briner, M.E. (Cornell Univ.), private engr'g. practice, East Orange, N.J., U.S.A.; Ashton Burton Cooper, B.S. (E.E.) (Tufts Univ.), Canadian General Electric Company, Toronto, Ont.; Karl H. Marsh, B.A. (Penna State Univ.), chief engr., Dominion Steel Corporation, Sydney, N.S.; Duncan McArthur, (Royal College of Science, London), principal engr. surveyor for Canada, for British Corporation Registry, Montreal, Que.; Robert H. Moore, gen'l. supt., Canada Creosoting Co., Toronto, Ont.; Walter Richard Pearce, B.A. (Queen's Univ.). chief engr., N.B. Telephone Company, St.John, N.B.; James George Harrison Purves, B.A.Sc. (McGill Univ.), chief constrn. & civil engr. Nova Scotia Steel & Coal Co., North Sydney, N.S.; William Seymour, B.S. (Univ. of Mich.), supt. coke ovens, Algoma Steel Corpn., Sault Ste Marie, Ont.; Charles Henry Speer, works engr., Algoma Steel Corpn., Sault Ste Marie, Ont.; Carl Stenbol, mech. supt., Algoma Steel Corpn., Sault Ste Marie, Ont.; Alexander Paul Theuerkauf, B.A. (Royal School of Tech., Dusseldorf, Germany), asst. chief engr., Dominion Iron & Steel Company, Sydney, N.S.

Associate Members

Mark Westaway Booth, steam engr., Dominion Iron & Steel Company, Sydney, N.S.; Herbert H. Cantwell, B.E. (Union Univ.), res. engr., Spanish River Pulp & Paper Co., Espanola, Ont.; John William Carlin, asst. city engr., Sydney, N.S.; Henry Emmerson Como, res. engr., Dominion Iron & Steel Company, Sydney, N.S.; George Sanford Davis, elect'l Engr., J. M. Robertson, Montreal, Que.; Wilfrid Laurier Dawson, B.Sc. (E.E.) (Queen's Univ.), telephone switchboard engr., Northern Electric Co., Montreal, Que.; George William Doherty, (Armour Inst. of Tech.), Dominion Iron & Steel Company, Wabana, Nfld.; James Richardson Donald, B.A., B.Sc. (McGill Univ.), consltg. chem. engr., J. T. Donald & Co. Ltd., Montreal, Que.; Ernest A. Duschak, C.E. (Cornell Univ.), mech. supt., at Regina refinery, Imperial Oil Company, Regina, Sask.; Peter Emslie, (Dundee Tech. Coll.),res. engr., for J. M. Robertson, Montreal, Que.; Starr Whitney Fairweather, B.Sc. (McGill Univ.), Grand Trunk Arbitration, Montreal, Que.; Charles Frederick Peter Faulkner, (Heriot Watt College), C.N.R., Victoria, B.C.; Geoffrey Abbott Gaherty, B.E. (Dalhousie Univ.), water power engr., also director, Montreal Engineering Company Ltd., Montreal, Que.; Alexander Loudon Hay, asst. mining engr., Dominion Coal Company, Glace Bay, N.S.; William Irvine Hay, (Glasgow & West of Scotland Tech. Coll.), prin. surveyor, British Corporation Survey & Registry of Shipping, Montreal, Que.; Lynn Irving Hirsh, asst. of constrn., Toronto Terminals Rly., New Union Station, Toronto, Ont.; Oluff Inkster, (Univ. of Alta.), P.W.D., of Alberta, Edmonton, Alta.; Douglas Mill Jemmett, M.A., B.Sc. (Queen's Univ.), asst. professor and acting head of dept. of elect'l engr'g., Queen's University, Kingston, Ont.; Hammond Johnson, B.Sc. (McGill Univ.), asst. engr., Lignite Utilization Board, Bienfait, Sask.; Clifford Rutherford Kinnear, asst. engr., Canadian Steel Foundries Ltd., Montreal, Que.; William David Lee, res. engr., constrn. dept., C.P.R., Winnipeg , Man.; John George Lennox, (Royal Glasgow Tech. Coll.), design & estimating, mech. dept., Dominion Bridge Co. Ltd., Lachine, Que.; Earl Ewing Litz, (Univ. of Colorado), combustion engr., Algoma Steel Corpn., Sault Ste Marie, Ont.; Eric William MacKay-White, of Edmonton, Alta.; Alvin Lawrence Malcolm, B.A.Sc. (Univ. of Tor.), res. engr., H.E.P.C. of Ontario, Campbellford, Ont.; Frank Harrison Mason, designing dftsman, H.E.P.C., Niagara Falls, Ont.; Ronald Morrison McKinnon, B.Sc. (Dalhousie & N.S. Tech. Coll.), city engr., Sydney, N.S.; Joseph Cave Meader, (Univ. of Tor.), Toronto, Ont.; Albert Lewis Mercieca, (Malta Univ.), H.E.P.C. of Ontario, Toronto, Ont.; Arthur Gillingham Pedder, asst. engr., steam power house, Ottawa Electric Rly., Ottawa, Ont.; Frederick William Pennock, managing director, Cleaton Company (Canada) Ltd., Montreal, Que.; John Wilbeet Purcell, H.E.P.C. of Ontario, Niagara Falls, Ont.; Frederick John Robertson, gen'l. supt., Calgary Power Co. Ltd., Seebe, Alta.; Frederick Arnold Rose, of Vancouver, B.C.; John Douglas Ruttan, rural engr., munic. of Fort Garry, Winnipeg, Man.; Edmund Gerald Ryley, B.Sc. (C.E.), (McGill Univ.), engr. and branch engr., Trussed Concrete Steel Co., Calgary, Alta.; John Edgar Sears, asst. engr., Welland Ship Canal, Thorold, Ont.; David Shepherd, B.Sc. (Eng.) (Edinburgh Univ.), partner in firm, C. H. & P. H. Mitchell, Consltg. Engrs., Toronto, Ont.; Joseph Duncan Stott, Dominion Bridge Co., Lachine, Que.; Robert Ambrose Strong, B.Sc., B.A., (Univ. of Illinois), acting chem. engr., Lignite Utilization Board, Bienfait, Sask.; John Lowry Gibson Stuart, B.A.Sc., (Univ. of Tor.), engr. of struct'l material, Pedlar People Ltd., Oshawa, Ont.; Irving R. Tait, B.Sc. (McGill Univ.), in charge of light heat & power dept., in connection with all plants, Canadian Explosives Ltd., Montreal, Que.; Philip Manly Thompson, B.A.Sc. (Univ. of Tor.), chief plan examiner, city arch't's. dept., City Hall, Toronto, Ont.; Edward Clough Tonge, B.Sc. (Tech.) (Univ. of Manchester), testing engr., coke oven dept., Dominion Iron & Steel Company, Sydney, N.S.; Robert George Watson, (Robert Gordon's Tech. Coll.), mech. supt., Iron Ore Mine, Wabana, Nfld.; Tyler Wellington Webb, B.Sc. (C.E.) (Univ. of N.B.), supt. of stripping operations, Minto Coal Co. Ltd., Minto, N.B.; Edward Augustus Wheatley, City & Guilds Tech. Coll.), registrar & sec. treas., Assn. of Prof. Engrs. of Prov. of B.C., Vancouver, B.C.; Stanley Alfred Wookey, B.A.Sc. (Univ. of Tor.), safety engr., McIntyre Porcupine Mines Ltd., Schumacher, Ont.

Associates

Alexander Brown Neilson, asst. engr., engr'g. dept., Winnipeg, Man.; James MacIntyre Stevenson, (Glasgow & West of Scotland Tech. Coll.), res. arch't., Dominion Govt. for Province of Alberta, Calgary, Alta.

Juniors

Christopher Gillette Russell Armstrong, B.A.Sc. (Univ. of Tor.), asst. supt. on constrn., Brunner, Mond Canada Co. Ltd., Amherstburg, Ont.; Walter Meryl Armstrong, (Queen's Univ.), of Ottawa, Ont.; David Alfred Yeadon Colquhoun, B.Sc. (M.E.), (N.S. Tech.Coll.), constrn. engr., Dominion Coal Co. Ltd., Glace Bay., N.S.; Lewis Murray Duclos, (Acadia Univ.), senior instr'man., asst. engr's. office, G.T.R., Montreal, Que.; Ernest Bruce Dustan, B.A.Sc. (Univ. of Tor.), dftsman., Canadian Bridge Co., Walkerville, Ont.; Gordon Maxwell Meighen Edwards, B.Sc., M.Sc. (McGill Univ.), of Ottawa Ont.; George William Holder, asst. to hydraulic engr., Spanish River Pulp & Paper Co., Sault Ste. Marie, Ont.; William Hughes, field dftsman., H.E.P.C. of Ontario, Niagara Falls, Ont.; John Saint John, efficiency engr., N.S. Steel & Coal Co. Ltd., Wabana, Nfld.; Victor Nelson Latimer, transitman, C.N.R., Winnipeg, Man.; Patrick Eugene McIlhargey, B.A.Sc. (Univ. of Tor.), sales engr., Lincoln Electric Co., Toronto, Ont.; Harold Allen Roberts, (N.S. Tech. Coll.), struct'l & mech. designer, Dominion Iron & Steel Co., Sydney, N.S.; Jack Roberts, dftsman., sewer dept., Dept. of Works, Toronto, Ont.; Louis S. Scotney George, asst. engr., Dominion Water Power Branch, Kamloops B.C.; Edward Samuel Spencer, instr'man., Nova Scotia Steel & Coal Company, Bell Island, Nfld.; Frederick Tisdall, chief engr., Moncton Branch, T. Eaton Co. Ltd., Moncton, N.B.; Olcott Wood Titus, B.A.Sc. (Univ. of Tor.) demonstrator in thermodynamics, Univ. of Toronto, Toronto, Ont.; Herbert James Whittaker, (Univ. of Liverpool), of Calgary, Alta.

Transferred from the class of Associate
to that of Member

Oswald Sterling Finnie, B.Sc. (McGill Univ.), inspecting engr. of mines & acting secretary, Northwest Territories, Dept. of the Interior, Ottawa, Ont.; Fraser Sanderson Keith, B.Sc. (Honours) (McGill Univ.), Secretary, *The Engineering Institute of Canada*, Montreal, Que.; Albert Wilmot Smith, B.Sc. (McGill Univ.), designing engr., C.N.R., Winnipeg, Man.

Transferred from the class of Junior
to that of Associate Member

Frederick Theodore Gnaedinger, B.Sc. (Met. Eng.) (McGill Univ.), constrn. engr., Algoma Steel Corpn., Sault Ste. Marie, Ont.; Arthur Emerson MacGregor, B.A.Sc. (Univ. of Tor.), engr'g. officer for Central Ontario, D.S.C.R., Toronto, Ont.; David Milton Mawhinney, munic. engr., municipality of Rockwood, Stonewall, Man.; Warren Cron Miller, B.Sc. (Honours) (Queen's Univ.), city engr., St. Thomas, Ont.; John Gerard O'Donnell, B.Sc. (Civil) (McGill Univ.), engr. for the Jos. Gosselin Co., Gen'l Contractors, Quebec, Que.; Charles McDowall Smyth, supt. of light & power Dept., Cape Breton Electric Company Ltd., Sydney, N.S.

Transferred from the class of Student
to that of Associate Member

Warren Leslie Dobbin, B.A.Sc. (Univ. of Tor.), engr. & asst. supt., Grant Contracting Company, Toronto, Ont.; John Leonard Foreman, B.A.Sc. (Honours) (Univ. of Tor.), hydrographic surveyor, hydro survey, Dept. of the Naval Service, Ottawa, Ont.; Leslie Stewart MacDonald, B.Sc. (Univ. of Alta.), D.L.S., dftsman., Hamilton Bridge Works Co. Ltd., Hamilton, Ont.

Transferred from the class of Student
to that of Junior

Treffle H. Imbleau, B.Sc. (Mech. Engr.) (Queen's Univ.), mech. engr., Ha Ha Bay Sulphite Co., Port Alfred, Que. and the Cie de Pulpe de Chicoutimi, Chandler Que.

EMPLOYMENT BUREAU

To make this department more valuable it is proposed that in future advertisements of situations vacant should state salary, and give details of requirements.

Situations Vacant

Office Engineer

An Office Engineer for the Reclamation Service, Department of the Interior, at Calgary, Alta., at an initial salary of $2,520 per annum, which will be increased upon recommendation for efficient service at the rate of $120 per annum, until a maximum of $3,120 has been reached. This initial salary will be supplemented by whatever bonus is provided by law.

Duties.—Under direction, to have charge of the examination and checking of maps, plans, profiles, and reports; to supervise the work of a number of employees engaged in making difficult mathematical computations and calculations in connection with engineering or survey work; to lay out and supervise the work of assistant office engineers, engineering clerks and draftsmen; to conduct correspondence; and to perform other related work as required.

Qualifications.—Education equivalent to high school graduation; either graduation in engineering from a school of applied science of recognized standing with three years of experience in field or office engineering work, two years of which shall have been in responsible charge of such work, or six years of experience in field or office engineering work, two years of which shall have been in responsible charge of such work; thorough knowledge of higher mathematics; in some cases knowledge of survey work or geodesy; ability to comple and make ready for publication the results of engineering investigations or surveys; tact and good judgment; supervisory ability. While a definite age limit has not been stated, age may be a determining factor when making a selection.

A rating on education and experience will be given from the sworn statements submitted by applicants on their application forms. To those who qualify an oral examination may be given, if necessary.

Preference will be given to residents of the province of Alberta.

Application forms properly filled in must be filed in the office of the Civil Service Commission not later than October 13. Application forms may be obtained from the office of the Employment Service of Canada, or from the Secretary of the Civil Service Commission.

By order of the Commission,

W. Foran,
Secretary.

Chief Trade Instructor for Penitentiary

Chief Trade Instructor for Penitentiary in Province of Quebec. Should be capable of taking charge of workshops, preference given to returned man and married man preferred. Ability to speak French and English absolutely essential. Salary with perquisites equivalent to about $200. per month. Box 211.

Situations Wanted

Designing Work Wanted

Structural engineer, college graduate, 15 years experience in design and construction of steel and reinforced structures, has time available for consulting and designing work with architects and engineers in or near Montreal. Has associated with him a first class mechanical and an electrical engineer. Box 84-P.

Electrical Engineer

Graduate member of English Society of Electrical Engineers, age 32, ten years experience including three years test plate, high tension A.C. and D.C., charge of sub-station, central station running and maintenance, open for immediate engagement, details and references on request. Box 85-P.

OBITUARIES

William James Stuart A.M.E.I.C.

Sincere regret has been expressed on account of the death of Lieut. William James Stuart, A.M.E.I.C., late Royal Engineers on 22nd August at Vancouver B. C. after a long illness resulting from gas poisoning contracted in France.

Mr. Stuart was born in Vancouver on 17th April 1889 and received his education at Vancouver High School, Columbian College and McGill University College, Vancouver. He was elected an associate member on 17th December 1918.

His early engineering work was on the North Western Railway in Idaho and later he was with the Canadian Northern Railway on the North Thompson River in B. C.

In 1911 he joined the city engineer's staff in Vancouver, being engaged mostly on paving work until the first week, in August 1914 when he enlisted in the Canadian Engineers and left for France with the first Engineer troops from B. C. with whom he shared the strenuous days of 1915-16.

Later he was granted a commission in the Royal Engineers.

Returning to Vancouver on demobilization in 1919 he resumed his duties with the city of Vancouver but after a few months he was overtaken by his fatal illness.

Lieut. Stuart was buried with military honours, the Royal Canadian Mounted Police providing the firing party.

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William James Davis, Jr.E.I.C.

William James Davis, Jr.E.I.C., of the engineering staff of the Wayagamack Pulp and Paper Co. Ltd., was accidentally drowned on September second while fishing in one of the lakes on the company's timber limits North of Three Rivers, Que.

Mr. Davis was born in 1884 at Lachine, Que., and after education in Montreal began his technical experience in the plant of the Locomotive and Machine Co. at Longue Pointe, Que. Following a short period with the Dominion Bridge Company at Lachine, Mr. Davis was transferred to their Winnipeg plant where he was from 1911 to 1918 chief draughtsman; in 1918 he joined the staff of the Wayagamack Company at Three Rivers.

The accident occurred while Mr. Davisw as out fishing in a canoe with a guide; the canoe was accidentally upset and the guide was unable to make the rescue. Mr. Davis is survived by his wife and two daughters.

PERSONALS

Edward C. Little, Jr.E.I.C., is construction engineer with D. G. Loomis and Sons, Montreal.

R. A. Spencer, A.M.E.I.C., has been appointed assistant professor in the University of Saskatchewan.

J. W. Porter, A.M.E.I.C., special engineer, Canadian National Railways, is now stationed in Winnipeg, Man.

T. L. Hughson, A.M.E.I.C., has been appointed vice-president of the Robertson Construction and Engineering Co., Limited, Niagara Falls, Ont.

F. T. Ames, A.M.E.I.C., has been appointed assistant to the chief engineer of the Luscar Collieries Branch Railway, Cadomin, Alta.

A. C. Brown, A.M.E.I.C., has been appointed chief engineer with J. P. Porter, Standifer and Porter Bros., contractors, Welland Ship Canal.

H. R. Lynn, A.M.E.I.C., formerly with the Maple Leaf Asbestos Co., has been appointed general manager of the Canada Slate Corporation, Thetford Mines, Que.

Raoul de M. Prévost, A.M.E.I.C., is now a paving engineer at the Montreal Branch of the Barrett Company, Limited.

F. W. Cowie M.E.I.C., read a paper before the American Society of Civil Engineers in New York on Sept. 7th, on "National Phases of Port Problems."

W. F. McKnight, A.M.E.I.C., has been appointed professor of electrical engineering at the Nova Scotia Technical College, Halifax, N.S.

Colonel T. V. Anderson, D.S.O., A.M.E.I.C., has been appointed general staff officer at the Royal Military College, Kingston, Ont.

E. Brydone-Jack, M.E.I.C., supervising engineer with the Dominion Department of Public Works has transferred his headquarters from Winnipeg to Victoria, B.C.

A. R. Whittier, Jr.E.I.C., until recently with the Structural Department of the Dominion Bridge Company, is now junior engineer for the Rideau Canal, Dept. of Railways and Canals, Ottawa.

G. R. Doull Jr.E.I.C., formerly assistant engineer Canadian National Railways, Moncton, N. B., has accepted a position as assistant in the office of the engineer of standards, Canadian National Railways, Toronto.

H. C. McMordie, A.M.E.I.C. until recently chief engineer of the Trussed Concrete Steel Company, Limited, has opened an office in Windsor, Ontario, where he will carry on business as consulting engineer.

J. A. L. Waddell, A.M.E.I.C., has been appointed member of the commission of four advisers to the Chinese government for the examination of designs submitted for the construction of the proposed bridge across the Yellow River.

D. Walter Munn, A.M.E.I.C., has resigned his position as professor of engineering and head of the engineering department with the Royal Military College, to become professor of mechanical engineering with the Nova Scotia Technical College., Halifax, N.S.

Louis Beaudry, S.E.I.C., has formed a partnership with Mr.Trepanier as engineers and contractors with offices in Three-Rivers, Que. Mr. Beaudry and partner are now engaged in the construction of a bridge over the Batiscan River at St. Stanislas, Que.

A. C. Fellows, M.E.I.C. is leaving the staff of the Quebec Harbour Commission to accept an appointment as chief assistant engineer for the construction of the Kilindini Harbour Works, British East Africa with Messrs. Coode, Matthews, Fitzmaurice and Wilson. Mr. Fellows expects to take up active work in British East Africa, very shortly.

John Pinder Moss, A.M.E.I.C., has been appointed director of technical education for the city of Anyox, B.C. and will take up his duties in Anyox in the near future. Mr. Moss previous to 1919 was head of the engineering department of the Technical High School, Edmonton, Alta., but was compelled to resign his position owing to a severe breakdown in health; his recovery and recent appointment are very gratifying to Mr. Moss' numerous friends.

F. W. Gray, A.M.E.I.C., has been appointed assistant to D. H. McDougall, M.E.I.C., vice-president of the British Empire Steel Corporation, Limited. Mr Gray was formerly with the Nova Scotia Steel and Coal Company, and for the past two years has been editor of "Canadian Mining Journal", and "Iron and Steel of Canada."

F. W. GRAY, A.M.E.I.C.

Research Council Officers.

The Honorary Advisory Council for Scientific and Industrial Research is to be congratulated on the fact that the chairmanship of the Council has been accepted by a prominent engineer, R. A. Ross, D.Sc., M.E.I.C.

R. A. ROSS, M.E.I.C.
President Honorary Advisory Council for Scientific and Industrial Research.

whose ability for the position is well known and under whose chairmanship the Research Council will doubtless accomplish beneficial results. The Council is further fortunate in the fact that Lt. Col. F. M. Gaudet, M.E.I.C., has been secured as technical executive officer. Colonel Gaudet's military record and his success as director of public safety for the City of Montreal, as well as the organization of the Civil Service Department demonstrate his particular adaptability for the requirements of this position.

New Chief Engineer, Dominion Bridge Company, Limited

F. P. Shearwood, M.E.I.C., who has recently been appointed chief engineer of the Dominion Bridge Company Limited was born in London, England, in 1866 and after attending evening classes at King's College, London, accepted a position with the Sao Paulo Railway Company, Brazil, with which company he remained until 1887. Coming to Canada, Mr. Shearwood entered the employment of the Dominion Bridge Company and has remained with the company since that date, rising from the position of draughtsman checker. During his connection with the Dominion Bridge Company, Mr. Shearwood has been associated in the design and construction of a number of important structures including the Alexandria Bridge, Ottawa, the Quebec Bridge, etc. For a number of years Mr. Shearwood has been an enthusiastic worker in *The Engineering Institute*, he was elected an Associate Member in 1892, transferred to Member in 1904; he has served as Councillor in 1909 and during the current year.

F. P. SHEARWOOD, M.E.I.C.

BRANCH NEWS

Vancouver Branch

J. N. Anderson, A.M.E.I.C., Secretary-Treasurer.

On the invitation of Hon. Dr. King, minister of public works for British Columbia, members of this Branch interested in paving work were taken for a day's inspection trip through the Lower Fraser Valley on Saturday 27th August.

The following members of *The Institute* were present: Major G. A. Walkem, Messrs A. E. Foreman, E. G. Matheson, W. H. Powell, J. A. Walker, A. Lighthall, J. T. Breckon, W. B. Greig and J. N. Anderson.

Messrs Sharpe, J. B. Winter, E. R. Vigor and Boyd completed the party of guests.

Patrick Philip, A.M.E.I.C., public works engineer, was unable to make the trip but was on hand before departure from the Vancouver Court House.

G. P. Napier, M.E.I.C., assistant public works engineer was in charge of the party and was accompanied by Messrs E. Dundas Todd, A.M.E.I.C., and D. W. Johnston, who has been in charge of the paving work in this district.

The trip was made by autos via Granville Street. Point Grey and Eburne where the first halt was called to inspect the asphaltic concrete laid on the timber decking of the bridge leading to Lulu Island.

The recently laid bitulithic pavements on roads 3 and 9, Richmond district, were next on the list and from this the party proceeded to Woodward's Landing, where the approaching road is paved with one-course concrete. Whilst waiting for the ferry at this point a most interesting discussion was entered into regarding the relative merits of bituminous and concrete roads.

During the ferry trip an opportunity was given to look over the contract drawings.

Reaching Ladner, the bitulithic portable plant was inspected and some time was spent in watching the mixing operations.

Luncheon was served in the Ladner Hotel during which Major Walkem, Chairman of the Branch, expressed the thanks of those present, Mr. Napier replying on behalf of Dr. King.

Leaving Ladner the party had an opportunity of watching the paving operations of the Bitulithic Company who are engaged in laying two inch bitulithic on macadam base for a length of six and a half miles on the Delta Trunk Road.

Between this last mentioned work and Cloverdale the party inspected scenery—which is well worth while—paving being "non est"!

At Cloverdale one-course concrete is being laid and an opportunity was given to inspect the contractor's plant and bunkers and also to see paving operations and the method of curing the finished roadway.

On the return trip a stop was made to examine the work being done by the Public Work Department at the Serpentine Flats where the road is being raised several feet, the required fill being obtained from the ditching operations alongside.

The journey was completed via the Pacific Highway, where last year one-course concrete pavement was inspected, Fraser River Bridge and New Westminster.

Altogether this was a most enjoyable and instructive trip, not only from an engineering standpoint but the weather was perfect and the route lay through a delightful farming district at the most interesting season of the year.

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Membership of Association of Professional Engineers of the Province of British Columbia

In a circular letter recently sent to the registered engineers of the province the following particulars are given as regards the membership of the Association of Professional Engineers of the Province of British Columbia.

380 civil engineers, 111 mining engineers, 92 mechanical engineers, 63 electrical engineers, 28 railway engineers, 20 structural engineers, 16 chemical engineers, 14 metallurgical engineers, 6 logging engineers, 5 forest engineers, 4 municipal engineers, 4 irrigation engineers, 2 telephone engineers, 5 various. These total 750 but owing to resignations and dual registrations actual membership is 730 in all.

98 applications have unavoidably been rejected or deferred but the Council hopes many of these applications will eventually qualify by examination or further experience.

Examining Boards have been appointed in each branch of engineering and arrangements are in hand for the first examination to be held in November as required by the Act.

Major G. A. Walkem, M.E.I.C., and Professor E. G. Matheson, M.E.I.C., attended the Western Professional Meeting at Saskatoon, the former representing the Councillors in British Columbia.

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Major C. R. Crysdale, M.E.I.C., left Vancouver on 3rd September for London, England, en route to the Gold Coast to take charge of railway construction for Major General J. W. Stewart, who is engaged on a large contract for the Imperial Government. Major Crysdale served in France with the Canadian Engineers, being O.C. First Tramways Company and was awarded the Military Cross,. Prior to the war he was engaged on the Pacific Great Eastern Railway in B. C., before which he was on the staff of the C. P. R. in both Eastern and Western Canada. On the eve of his departure Major Crysdale was guest of honour at a luncheon given by the Pacific Coast Branch of the University of Toronto Engineering Alumini Association.

Calgary Branch

Arthur L. Ford, M.E.I.C., Secretary-Treasurer.
Floyd K. Beach, A.M.E.I.C., Branch News Editor.

The summer recess of meetings of the Branch will end and fall activities will start with an illustrated talk by Lt. Col. H. C. Boyden of Chicago, who will address the Branch on October 4th on "Recent Developments in Concrete". Though no regular meetings of the Branch have been held during the summer, the membership has been far from idle, and a report on the individual work of the membership if given in full, would show that the activities of a large proportion have been directed toward irrigation.

The droughts of the last few years in Southern Alberta have brought the need of irrigation to the attention of the whole province, and the engineering and financial problems involved in securing irrigation are being rapidly solved.

B. L. THORNE,M.E.I.C.
New Chairman Calgary Branch

The systems built by the C.P.R. are reaching a state of productiveness, as the colonization schemes have been successful in placing farmers on a large proportion of the lands served. The Canada Land and Irrigation Company have made progress in colonization and in the application of water during the year. The Taber Irrigation District have used water, and the Lethbridge Northern Irrigation District have secured funds and at the moment of writing, over a quarter of the total excavation has been completed and contracts for nearly all portions of the work have been let. Some details of recent contracts on this scheme are given a little farther on. The United Irrigation District have been fully organized and though their bonds have not yet been sold, they have been sufficiently financed to enable them to engage an engineer, and location stakes are being set for anticipated 1922 construction. The engineering work of this district was let to D. W. Hays, M.E.I.C., formerly chief engineer of the Canada Land and Irrigation Company. The scheme involves the irrigation of some 23,000 acres lying between the Belly and Waterton rivers. A number of other districts are in various stages of formation. Among those that seem to be almost certain to be successful in their efforts may be mentioned. South Macleod district involving the irrigation of some 60,000 acres by water from Waterton river. Retlaw-Lomond district involving some 70,000 acres of irrigable land. Eyremore district covering some 10,500 acres. Riverbow district, irrigable area not yet fixed. Vauxhall district, irrigable area not yet fixed. Champion district, involving some 50,000 acres. Little Bow district, which involves turning water from Highwood river into Little Bow river and pumping it at several points from the latter river to flats situated from 12 to 54 feet above the river.

Besides the above schemes, more full reports of which have been published in local papers, the Alberta Gazette and reports of the Reclamation Service, Dept. of the Interior, at least two large schemes have been contemplated. One of them, the Lethbridge Southeastern District, involving some million acres of which over 500,000 acres are susceptible of irrigation, is in abeyance pending a decision by the International Joint Commission as to division of international waters.

The other, known as the North Saskatchewan Project, iinvolves a rather large area in Saskatchewan as well as some areas in Alberta. It is understood that surveys for both these schemes are being undertaken, but they have not reached a point where the schemes are ready for the organization necessary prior to financing and constructing them.

Contract Prices, Lethbridge Northern Irrigation District

Steel work, Oldman and Willow creek crossings; substructure for flumes. Let to the Dominion Bridge Co., for $110,386. Unit prices are not available at the moment, but the tender was at a figure very favourable to the district, being about 25% below the next lowest.

Metal flumes for the above crossings let to the Pacific Sheet Metal Works of Vancouver. Contract price $43,987.50 being $11.25 per lineal foot for a semi-circular galvanized section 14 feet in diameter.

Two siphons of wood stave pipe let to the Canadian Pipe Co., of Vancouver. Contract price $121,687.75, being $40.85 per lineal foot of siphon, 10′6″ inside diameter.

Headworks (concrete) let to A. G. Creelman & Co., of Calgary. Contract price $364,619.50. Unit prices are not available at time of writing but the figure was considered very favourable to the District. Six other tenders ranged up to $432,702.

Machinery for headgates let to Manitoba Bridge & Iron Works, Winnipeg, for $17,700. Five other tenders ranged up to $31,000.

Some of the above figures are taken from press despatches and are subject to typographical errors.

The above contracts conclude most of those to be let this year, though it has been proposed to purchase some timber to be delivered at various stations so that employment may be given to local farmers through the winter in hauling it to the places where it will be used.

The International Joint Commission who have the duty of administering the division of boundary waters between the United States and Canada under the Treaty, met in Chinook, Montana on Sptember 15th in order to give the local public a chance to present their views in regard to this matter. The Commission then adjourned to Lethbridge where a similar meeting was held.

As a result of these meetings we look for an early solution of the difficulty. This might possibly be reached at the annual meeting of the Commission which is being held in Ottawa, October 4th.

In this connection it will be remembered that a resolution was passed at the Western Professional meeting in Saskatoon urging the necessity of an early decision in the matter as the development of a large amount of land in Southern Alberta was being held up on account of the delay in reaching a solution of this matter.

Capt. J. J. Hanna, A.M.E.I.C., who has been assistant secretary of the Branch resigned that post recently on leaving the city. On completion of the concrete work of the new Hillhurst bridge in Calgary, Capt. Hanna accepted an offer of a position with the Lethbridge Northern Irrigation District who are shortly starting extensive concrete construction.

J. A. Spreckley, A.M.E.I.C., has been appointed assistant secretary in Capt. Hanna's place.

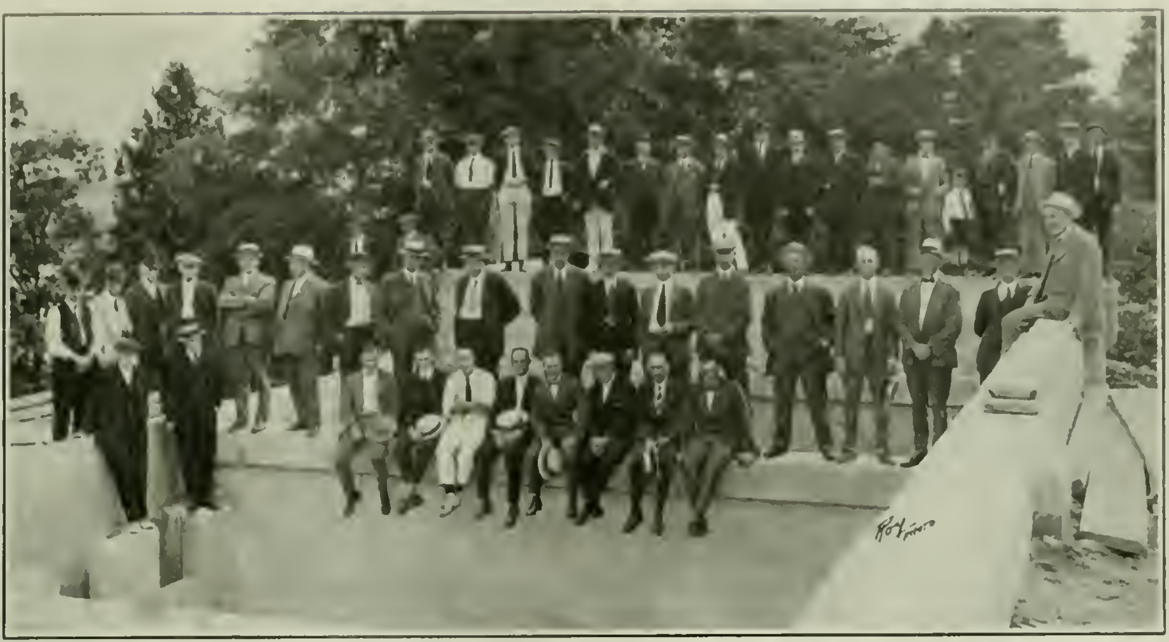
Peterborough Branch

D. L. McLaren, A.M.E.I.C., Secretary.

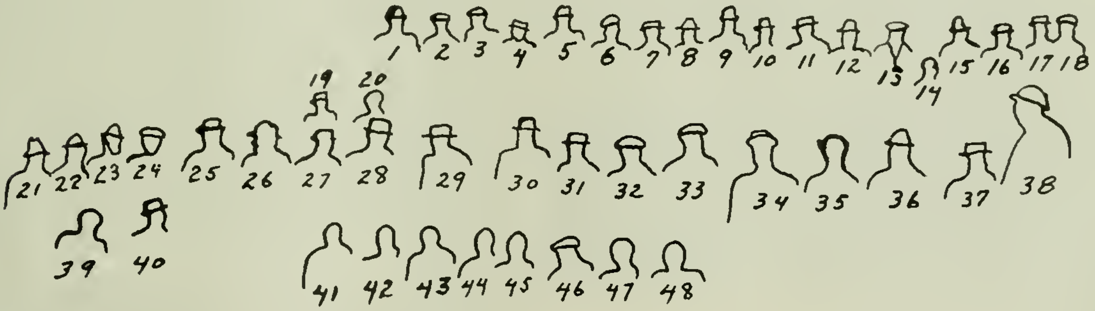
A party of 50 members representing the Peterborough Branch of *The Engineering Institute of Canada* held their annual picnic on August 12th. The programme included an inspection of Peterboro's new 6,000,000 gal. filtration plant and the Canadian General Electric Co's new power dam on the Otonabee River at Nassau, both of which are in process of construction, and a motor run to the Karwartha Lakes at Lakefield, where a series of athletic contests and dinner was held.

In the baseball game, the Electrical Engineers challenged the field, the final score being 15-12 in favour of the Electrical . For the Electricals, Shirley's home runs and Convery's curves were a feature, while for the loosers, Jas. MacIntosh grabbed everything around short and Ross Dobbin did some spectacular work at pitching. His fielding was also good, although he showed a preference for straight balls, waist high.

Messrs. Shirley and Dobbin had charge of the arrangements for the picnic and had not several members been away on their holidays, the turnout would have comprised the entire membership of the Branch.



Annual Picnic, Peterborough Branch



1. A. A. Richardson
2. E. R. Shirley
3. A. P. Sills
4. A. Irwin
5. Geo Coutts
6. H. A. Fife
7. W. G. Corneel
8. W. M. Cruthers
9. H. Grills
10. F. M. Somerville
11. P. Alexander
12. H. C. Norley
13. J. Marshall
14. Jim Rogers
15. C. H. Rogers
16. W. H. Barry
17. R. C. Flitton
18. J. C. Wilde
19. J. B. Wolcott
20. A. P. Miller
21. John Sentie
22. R. G. Sturgeon
23. E. F. Mason
24. F. H. Dobbin
25. R. L. Dobbin
26. W. H. Pretty
27. A. Brown
28. D. Easson
29. A. E. Coddy
30. G. L. Jones
31. H. Rose
32. J. E. Hess
33. A. B. Gates
34. R. B. Rogers
35. P. L. Allison
36. P. P. Westbye
37. R. A. Hinton
38. G. W. Gladman
39. John Barnes
40. J. H. Convery
41. J. A. Jaegar
42. R. C. Hardie
43. P. H. Manning
44. C. D. Cook
45. C. E. Sisson
46. Alan Munro
47. Barry Ottewell
48. J. A. Mackintosh

Winnipeg Branch

Geo. L. Guy, M.E.I.C., Secretary-Treasurer.

On Thursday, 1st. September, the first meeting of the new session of the Manitoba Branch was held in the University Building, Professor E. P. Fetherstonhaugh M.E.I.C., occupying the chair.

A report was presented to the Branch on the Western Professional meeting held at Saskatoon in August and the Chairman complimented the Branch on the large number of Winnipeg members who were present.

Professor Finlayson, M.E.I.C., reported on the papers read by the committee investigating the effects of alkali on concrete. He outlined what had been done to date and what it was proposed to do, emphasizing the necessity for this investigation, which, he pointed out, was economically one of the most important problems at present before the community, particularly in the West, where, owing to the nature of the soil, the large amount of concrete construction work recently carried out and also the prospective work yet to be done, it was imperative that some definite cure should be found for the existing trouble. His report led to an active discussion in which a large number of the members took part. It was suggested that even if the investigating committee were unable to come to any definite decision or failed to obtain results which would merit publication they should take some means of informing the members of the profession as to what had been done and what means might be looked to to mitigate the existing condition.

M. A. Lyons, M.E.I.C., chief engineer, Provincial Good Roads Commission, reported on the papers and the activities of the committee who were endeavouring to draw up standard specifications for good roads. He pointed out that the subject was one which not only included the engineering features but really amounted to a definite policy to be followed by the different governments interested and for that reason exceptional care would have to be taken by the committee before it made any recommendation.

W. M. Scott, M.E.I.C., commissioner, Greater Winnipeg Water District, reported on the paper on General Welfare and his report resulted in one of the most active discussions which the Branch has had, practically every member present taking part. A great diversity of opinion was expressed by the members in general and the discussion went a good deal outside of the actual scope of the original paper. In this discussion one point of interest was brought out which is worthy of mention, namely, that in the recent business tax instituted by the provincial government, in which the professions were exempt from this tax, opposition has been found among government officials in exempting engineers from this tax, one member of the government claiming that engineers did not come under the definition of professionals. The Association of Professional Engineers of the Province of Manitoba had, however, taken legal opinion on this matter and the members were informed that, legally, engineering was recognized as a profession and acknowledged as such by the provincial government and therefore engineers were entitled to claim exemption from this tax.

A report from the executive committee on the proposed arrangements for the Annual Meeting of *The Institute* to be held in Winnipeg was presented to the meeting. The report dealt with the skeleton organization which had been formed to take up the various activities and the Chairman emphasized that because a member had not been placed on any of the committees was no reason why he should not actively work to make the meeting a success, as it was only by co-operation of all members that the Branch could do justice to the occasion.

Fort Norman Oil Fields

On Thursday, September 15th., a meeting was held in the Engineering Buildings, Manitoba University, E. P. Fetherstonhaugh, M.E.I.C., in the chair.

Mr. Bloom, special correspondent for the Winnipeg Tribune and Calgary Herald, who recently visited the Fort Norman Oil Fields for the above papers, addressed the meeting on the Fort Norman Oil Fields, Mr. Bloom's paper was illustrated by lantern slides. The speaker limited his discussion practically entirely to methods of getting into the country, describing the different routes which could be taken and means of transportation adopted and also the general nature and topographical features of the country, as he stated that not being a technical man he did not feel competent to enter into the geological facts. Among the slides shown were many showing the existing drillings of the Imperial Oil Company in different places where they were drilling. He also dealt at some length with the climatic conditions and agricultural possibilities of the country.

Owing to the general interest of Fort Norman Oil Fields the meeting was thrown open to the public, which resulted in a large attendance, there being nearly 200 present.

The executive committee reported on proposed programme of the Annual Meeting in Winnipeg to be held in February next. Owing to the public nature of the meeting no business was discussed.

Town Planning Notes and Comments

H. L. Seymour, A.M.E.I.C.

NOTE:—*In order to make this column of wide interest to members of The Institute, personals and items of town planning interest will be appreciated. Address: H. L. Seymour, A.M.E.I.C., 40 Jarvis Street, Toronto.*

Government Assistance in Town Planning

In view of the public announcement that the duties of the Commission of Conservation would shortly terminate it is of interest to town planners to know what provision is being made for federal aid to town planning. The town planning division of the Commission of Conservation has been transferred to the National Parks Branch of the Department of the Interior. It is announced that the work of the division will not be materially changed, but attention will be chiefly directed in future to purely federal matters, including town planning and park developments in connection with the National Parks. Matters connected with provincial legislation and local town planning schemes will be left to the initiative of the provincial and local authorities, but where requests are made by these authorities for assistance and co-operation it will be readily given by the department.

Thomas Adams will continue to act as town planning adviser, with W. D. Cromarty, architect, and Alfred Buckley, M.A., as assistants. A considerable saving of expense to the government will be effected as the result of a new arrangement with Mr. Adams, under which he will devote part time to the government and the larger part to private work in England and the United States, with headquarters in London, England. He retains his position as town planning adviser, but will devote only part of his time each year to that work. He expects to return to Canada within a few months. He is also engaged to plan two Canadian cities. Mr. Adams has been in Ottawa for seven years.

Previous to Mr. Adams' work in Canada the names of Sir Clifton Sifton, chairman of the Commission of Conservation, James White, M.E.I.C., assistant chairman and Dr. Hodgetts will be remembered for their pioneer work with regard to government assistance in town planning. The interest displayed in town planning by these energetic members of the Commission it is understood was responsible for the establishment of a town planning department in the Commission.

The scope of the federal assistance to town planning has been largely of an advisory nature as constitutionally each province must prepare its own town planning legislation. The Province of Saskatchewan has taken the widest advantage of the opportunity. It has not only passed a comprehensive town planning act but has a very active town planning department with W. A. Begg, A.M.E.I.C., as town planning director.

The following is extracted from a recent editorial in a leading Canadian journal.

The New Town of Lens

> The new town of Lens in the Province of Saskatchewan promises to be one of the most interesting and significant memorials on this continent of the great war. It is being laid out under the jurisdiction of the Soldiers' Settlement Board on the most modern town planning lines according to a plan prepared in the office of the Surveyor-General and is, incidentally, an illustration of the benefit of a provincial town planning act. Saskatchewan has one of the best and most advanced town planning acts in the world. From the provincial centre information is now going out to the new settlements concerning the general social and commercial benefits of orderly town development and of the human and cash value of beauty, and wherever development is manifestly wrong the provincehas the right to interfere and by mandamus put a check to the evils that have ruined the prospects of so many towns in Canada from their birth.

Town Planning Convention, Toronto

Toward the latter end of October the Ontario Town Planning and Housing Conference expects to hold a convention which will be attended by numerous delegates from all parts of the Province. It is expected that some experts from the Chicago City Planning Commission will attend and deliver addresses. Special attention will be devoted to what can be accomplished under existing legislation. J. P. Hynes, A.M.E.I.C., of Toronto is chairman of the Ontario Town Planning and Housing Conference and W. S. B. Armstrong, Toronto, is secretary.

Toronto Branch, Town Planning Institute

A meeting of the Toronto Branch was held on Friday September 16th at the National Club. Following an informal dinner to which prospective members were specially invited, Reginald Dann, town planning adviser of the Madras Government, India, now touring America, spoke on the "Present Day Tendencies of Town Planning Development in England, Germany and America." N. D. Wilson, A.M.E.I.C., gave a comprehensive talk on "Town Planning Aspects of the Toronto Harbour Commission Scheme."

The Linear City

The death of Don Arturo Soria Y Mata of Spain recalls to our attention his proposals back in the eighties for urban development which has been termed "The Linear City". By a power driven tramway he proposed to encircle the city of Madrid. Along such artery he intended that there should be built houses. Between the city of Madrid and such a linear city there would be left open spaces never to be built upon. A part of his scheme has now been carried out. The principle of the lineal city is offered as one solution of the difficulties encountered in urban growth.

"School" Men to Gather

Annual Meeting of Toronto Engineering Alumni

Elaborate preparations are under way for the third annual gathering of "School" men, which will be held in Toronto on the 4th and 5th of November. Arrangements, this year, are being made on a much larger scale than in previous years and it is expected that among the long list of distinguished guests will be one or two of international reputation. The graduates are coming from all parts of Canada and the United States and it is expected that upwards of one thousand will attend the reunion. At the Annual Meeting on saturday morning, broad questions relative to university policy, technical education and professional matters will be discussed.

Annual Meeting Announcement

The annual general meeting of *The Engineering Institute of Canada* will be held at Montreal on Tuesday, January 24th, 1922, at ten o'clock A.M.

At this meeting the formal business of the annual general meeting will be presented. The agenda will consist for the most part of appointments of scrutineers; appointment of auditors ; reception of reports, (a) report of Council, (b) reports of committees, (c) reports of Branches; new business ; reports of scrutineers announcing election of officers.

This meeting will be adjourned to **Winnipeg, February 21st, 22nd and 23rd,** where unfinished business of the annual meeting will be continued and the annual general professional meeting will be held under the auspices of the Winnipeg Branch. The programme of the professional meeting, details of which will be announced later, is at present under consideration by the Winnipeg Branch.

The Winnipeg Branch anticipates, and is providing for a large attendance and it is sincerely hoped that many members both East and West of Manitoba will plan to be present. It is expected that special arrangement will be made for a train from the East and possibly from the West coast, for those attending the meeting.

Preliminary Notice

of Applications for Admission and for Transfer

19th September, 1921

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate member a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in October, 1921.

FRASER S. KEITH, Secretary.

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*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option, Railway, Municipal, Hydraulic, Mechanical, Mining or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects, Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits cientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

GRUPP—CHARLES A., of Waterdown, Ont. Born at Chicago, Ill., Jan. 29th 1897; Educ., 1914-15, Sch. of Engr'g., Cooper Union, New York City. 1915-16, Prac. Sch. of Forestry, Syracuse Univ., 1916 18, Faculty of Forestry, Univ. of Tor.; 1913-14, dftsman and material man, Underpinning and Foundation Co.; Summer 1915, forest survey, Rich Lumber Co., Adirondacks, N.Y.; 1917, timekpr. etc., James A. Wickett, Toronto; 1918, forest survey, Conservation Commission, Quebec; part of seasons, 1918-19-20, with Frank Barber, County Engr.; 1920 (2 mos), Timber Investigation Committee; 1919-20, layout man, Jackson & Lewis, Contractors; 1920-21, dftsman, H.E.P.C.; At present office man, Dept. of Public Highways of Ontario at Waterdown, Ont.

References: A. V. Trimble, F. Barber, R. O. Wynne-Roberts, H. L. Seymour, G. R. Jack, H. A. Goldman, A. H. Harkness.

JUDGE—JOHN WILLIAM, of Edmonton, Alta. Born at Renfrew, Ont., Aug. 8th 1888, Educ., Renfrew Collegiate Institute, 1904-06, rodman, T. & N.O. Rly., 1906-11, rodman, and instr'man., C.P.R., 1911-16 and 1919-20, with Edmonton Dunvegan & B.C. Rly., as follows: 1911-12, transitman on location, 1912-13, res. engr., 1913-16, mtce. engr. in charge of all ballasting, tracklaying, bldgs. and bridges 1916-19, overseas Lieut. and a Capt. Can. Engrs. and 7th Battn. Can. Rly. Troops 1920-21, dftsman., Alberta & Great Waterways Rly.; May 1921 to date, constrn. engr., in charge of all ballasting, Alberta & Great Waterways Rly.

References: T. Turnbull, W. Burns, E. K. Hall, J. G. Reid, J. W. Porter, W. R. Smith, L. B. Patterson, E. J. Bolger, H. Wellwood.

LANCTOT—JEAN JACQUES, of Quebec, Que. Born at Montreal, Que., Oct. 20th 1891, Educ., 2 years Applied Science, McGill Univ., 1 year Ecole Poly. Montreal; 1913, asst. to E. A. Evans, C.E. on party for estimate of cost on constrn. of projected rly. between James Bay and Port Nottaway Village; 1914 (summer), asst. of C. E. Lemoine, L.S. surveying of rivers and lakes in northern Abittibi; 1915 (summer), tester & inspector of steel & tools for the Ross Rifles Factory, Quebec; 1916 (summer), asst. of Joachim Fortin, C.E., constrn. of hydro-electric power on Ha. Ha. River for the Chicoutimi Pulp & Wood Co.; 1917-19, overseas, lt F.C. Wounded. Discharged permanently unfit; 1920, gen. supt. of roads and bridges constrn. in the counties of Chicoutimi and Lake St. John for the Provincial Bldg. & engr'g Co. of Montreal, also for P. C. Costo et Frere (Contracting firm of Montreal). 1921 road inspector for the Ministry of Roads of the Prov. of Quebec.

References: A. R. Decary, A. B. Normandin, E. A. Evans, J. A. Lefebvre, J. E. Roy, A. Amos, A. Fraser.

MARTIN—LAWRENCE THOMAS, of Ottawa, Ont. Born at Arnprior, Ont., June 11th 1884; Educ., Renfrew Collegiate Institute; 1901-06, with T & N.O. Rly., 2 years as instr'man., 1 year as res. engr.; 1906-14, managing partner, contracting firm, O'Brien & Martin, in Northern Quebec; 1914-15, managing director, Great Lakes Dredging & Contracting Co., Ottawa, Windsor, Port Arthur & Fort William, completing dredging and harbour works; 1916-18, O.C. 7th Batt. Can. Rly. Troops (overseas). At present, commissioner, T. & N. O. Rly., managing director, Great Lakes Dredging & Contracting Co. Ltd., and managing partner, O'Brien & Martin.

References: W. P. Wilgar, J. G. G. Kerry, G. Grant, H. B. R. Craig, K. M. Cameron, A. E. Doucet, J. M. Wilson, F. S. Keith.

PATTENDEN—ALBERT HENRY, of Montreal, Que. Born at London, England, Dec. 23rd 1889; Educ., 2 years evening classes Borough Polytechnic. 1903-07, ap'tice to Everett Edgecombe, London, England, Elect'l & Mech. Engrs.; 1907-10, with Montreal Light Heat & Power Co.; 1910-12, with Monarch Electric Co., Montreal; 1912-16, foreman, electric car dept., C.P.R. Angus Shops; 1916-18, with W. J. Leahy, in charge of electr'l and mech. development work in connection with new invention (Impulse Motor); 1918 to date, electr'l engr., Canadian Consolidated Rubber Co.

References: J. A. Shaw, J. M. Robertson, F. A. McKay, J. T. Farmer, L. A. Kenyon.

SMITH—RICHARD CURTIS, of Montreal, Que. Born at Ledbury, Herefordshire, England, Dec. 29th 1882; Educ., Bach. of Science, Tufts College, Mass., 1906; 3 years, dftsman and checker, American Bridge Co.; 3 years instructor in struct'l engr'g. and asst. in testing materials laboratory, 6 years asst. professor. struct'l. engr'g. and in charge of testing materials laboratory, 1 year in charge of constrn. of barrack and mess halls for S.A.T.C., U.S. Army, Tufts College, Mass.; 1 year estimator and in charge of dfting.room contract dept., Mead-Morrison Mfg. Co., East Boston, Mass.; 2 years to date, contract engr., Canadian Mead-Morrison Co., Ltd., Montreal.

References: R. W. Leonard, R. P. Raynsford, S. C. Wolfe, A. R. Rutledge, S. Barr.

WICKENDEN—JEAN FRANCIS, of Bridgeburg, Ont. Born at Anvers-sur-Oise, France, Jan. 19th 1896; Educ., B.Sc., McGill Univ., 1920; 1913-14, with Joseph Rielle, C.E.; 1914 (5 mos) and 1915 (5 mos), St. Maurice Forest Prot. Anns.; 1916 (5 mos), Geol. Survey of Canada (topog'l); 1917 and 1918, A. E. F. Road Engr.; 1917 (6 mos), chief asst. Geol. Survey of Canada; 1920 to date, contracting dept., (contracting engr.), Horton Steel Works Ltd., Bridgeburg, Ont.

References: R. L. Seaborne, H. M. MacKay, E. Brown, H. M. Lamb, C. M. McKergow, R. De L. French, L. R. Thompson.

FOR TRANSFER FROM CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

ARMSTRONG—WALTER JAMES, of Strathmore, Que. Born at Fair Hill, Maryland, U.S.A., August 6th 1885; Educ., Mech. Engr., Cornell Univ., 1909; 1909-12, with Messrs. Westinghouse, Church, Kerr & Co., New York City, as follows—1909-11, asst. engr., Feb.-Aug. 1911, asst. chief engr., Aug. 1911 to July 1912, chief engr., 1912-13, engr. in charge of design and purchase of materials, Montreal Office of above firm; 1913-14, asst. chief engr., of Messrs. Ross & Macdonald's Engineering Department. 1914-17, asso. engr. in charge, and 1917 to date, engineer in charge of above department.

References: J. M. R. Fairbairn, H. Holgate, R. S. Kelsch, J. R. W. Ambrose, J. C. Smith, F. L. C. Bond.

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VOLUME IV MONTREAL, NOVEMBER 1921 NUMBER 11

Experimental Work in Connection with the Manufacture of Silica Brick

Development of a new industry in Nova Scotia by Dominion Iron and Steel Company, Limited.

A. W. McMaster, A.M.E.I.C.

Paper presented before Cape Breton Branch, The Engineering Institute of Canada, May 1921.

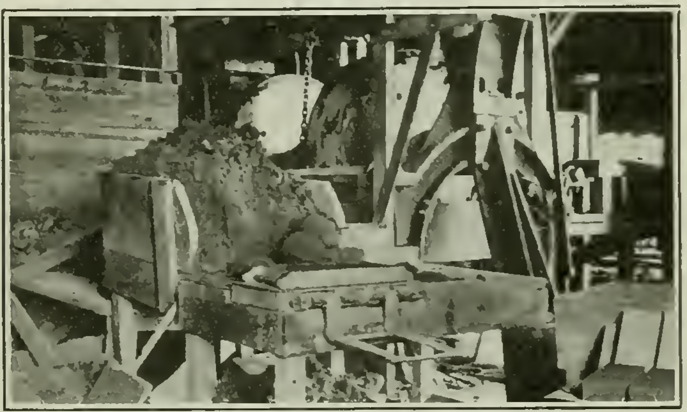
Owing to the increase in the cost of silica brick and the difficulties in obtaining them, in sufficient quantities, due to war conditions, it was decided in the Spring of 1917 to look into the practicability of making silica brick locally.

Field work carried on that summer indicated that three properties in Cape Breton showed promise of containing a sufficient tonnage of quartzite or silica rock to make them possible sources of raw material, and further investigation proved that each of these deposits, Skye Mountain, Aberdeen and George's River, contained stone suitable for refractory purposes.

It might be well here to give a definition of a suitable quartzite for refractory purposes. Three properties of the quartzite should be considered:—

No. 1. — Mechanical strength
No. 2. — Melting point
No. 3. — Behaviour on burning.

Experience has shown that to produce a physically strong brick, the stone must be hard, dense and give splintery angular fragments of heterogeneous size on crushing, one that crushes down to rounder grains cannot be used. The strength of a brick and its melting point are conditional by the analysis of the rock. The silica content may vary from 96 to 98 %, if less silica is present, the fusion point is lowered. Attempts to use pure quartzite of 99% silica dioxide (SiO_2) have not met with success. The presence of alumina (Al_2O_3) or ferric oxide (Fe_2O_3) is necessary to form a bond. Their combined percentage is usually 1.75% and should not exceed 2.5%. The amount of alkalies should be less than .5%



Moulding Table with Grinder, or Wet Pan, in background
The batch was shoveled from the Wet Pan in motion on to the Moulding Table.

Comparative Analyses

Quartzites

Constituent	Medina Pennsylvania	Baraboo	Alabama	Skye	Aberdeen	George's River
Silica, SiO_2	97.80	97.15	97.70	97.27	96.87	97.41
Alumina, Al_2O_3	.90	1.00	.96	1.42	1.46	1.07
Iron Oxide, Fe_2O_3	.85	1.05	.80	.59	.59	.73
Lime, CaO	.10	.10	.05	.11	.07	.11
Magnesia, MgO	.15	.25	.30	.29	.34	Tr.
Alkalies	.40	.10	.31			
Loss Ignition				.44	.59	.44
	100.20	99.65	100.12	100.12	99.92	99.76

American authorities give typical analyses of suitable quartzites, which are compared with average analyses of rock from the localities previously mentioned.

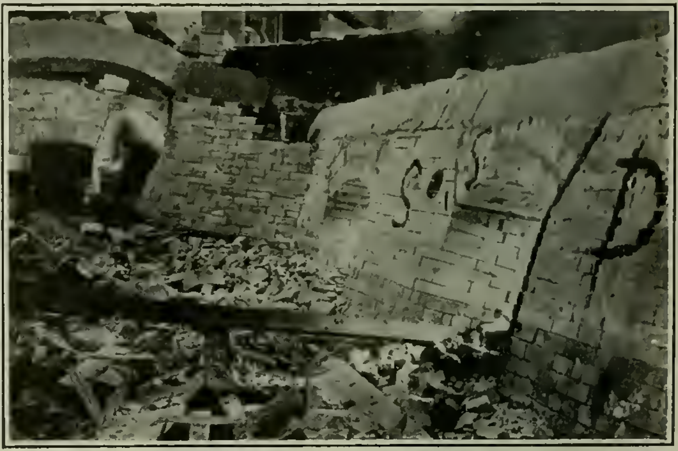
It will be noted that they all come within the requirements as specified for refractory purposes. The silica contents being respectively, 97.27%, 96.87%, 97.41%, which is between 96 to 98%. The combined alumina and iron oxide being respectively — 2.01%, 2.05%, 1.80% which is between the limits of 1.75% and 2.5%. Each of these quartzites break on crushing into splintery fragments. George's River stone giving the most perfect analysis and made the best brick as tests referred to later show.

Our experimental plant was located in the South end of one of our open hearth brick sheds, on account of there being an 8′-6″ Clearfield dry pan installed there, for grinding brick bats. This was converted into a wet pan by replacing the slotted bottom plates with solid cast iron ones.

The necessary flooring, runway, bin and platform were built about the grinder and the following equipment provided:—

2 — ½ barrels calibrated to gallons.
1 — moulding table with turnover device, necessary moulds and tools.
1 — stripping bench with sand box.
2 — rack cars.
150 — sheet iron trays.
1 — dryer house, capacity for two rack cars.
1 — down craft kiln — size about 10′ x 17′ x 9′-6″ inside. Capacity — 7500 — 9″ eq.
Necessary track 2 ft. gauge, from moulding table through dryer house to kiln with turntable and spur to allow the return of empty car to moulding bench.

Both ½ barrels were fitted with 1-¼″ piping and valve. The one used for slacking the burnt lime to make the milk of lime — had a fine wire screen over the end of the pipe — the other ½ barrel contained water to add to mixture if required, both were blocked up on platform to allow contents to feed into the wet pan by gravity. Silica brick expands on burning so the moulds are made smaller than the desired size of brick, allowing ⅜″ — 7/16″ per foot — for expansion.



Views showing inside of No. 9 Open Hearth Furnace under repair. One-half built of Harbison Walker "Star" Silica brick, indicated by "S", the other half built of our own Silica brick, marked "D."

Three lots of 3½ tons of rock, sufficient to make 1000 bricks, were procured from each of the localities mentioned. Any stone, requiring to be reduced in size to pass through a 2″ ring, was broken with a stone hammer. We adopted a standard batch sufficient to make 100 bricks consisting of:—

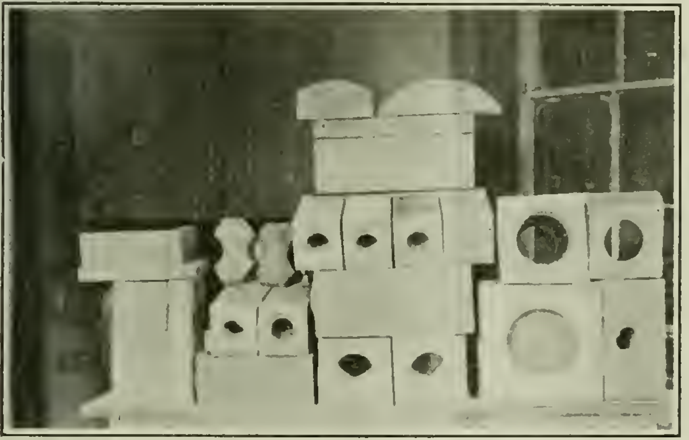
700 lbs. of rock
14 lbs. of burnt time (i.e. 2% by weight)
12-14 gallons water.

The rock was weighed carefully and placed in the bin at the top of the runway The lime also was carefully weighed and slacked in 60% by weight of water — to which was added 11 or 13 gallons of water, making the milk of lime. It is preferable to use warm water to slack the lime.

When everything was in readiness the grinder was started and the gate of bin opened, feeding the stone into the grinder gradually — The rock was ground from 15 to 18 minutes, during this time the milk of lime was added and then more water if necessary to bring the mixture to the proper consistency. Then the mud was shovelled out of the pan in motion on to the moulding table.

Our crew consisted of —
1 — foreman
1 — moulder
1 — moulder's helper
1 — material man

The sanded mould being in place on the turnover device on the mould table, the mud is picked up by hand, thrown into and heaped over the mould and pounded with a flat mallet, then cut off level with the mould and smoothed over with a slicker or two handled trowel. The helper then places a tray bottom side up on the mould, turns them over and places them on the stripping bench — immediately after, placing a sanded mould before the moulder for him to carry on. He then strips the green brick by placing a stripper made of wooden blocks attached to a small board over the filled spaces and steadily pulls up the mould, using the stripper as a guide. Thus leaving the green brick on the tray, which is placed on the rack car. Lead figures were fastened on the underside of the stripper blocks to mark on the brick when stripping, the number to indicate locality the quartzite or silica rock came from. When the car was filled (288 brick) it was placed in the dryer house. The moulding of sufficient brick to fill the two rack cars (576 brick) was considered a day's work, being equal to the capacity of the dryer. It took 12-15 hours to dry the brick bone-dry at a temperature of 250-270 degrees fahrenheit.



Different shapes of Clay Brick made by Experimental Brick Plant from local clay and crushed brick bats. Large shapes are Runner Bricks used for bottom pouring of Ingots for use in Plate Mill.

Next day the cars were pushed into the kiln and the bricks stacked on edge, two rows being set in the same order and the next two rows at right angles — and so on — no. 2 quality silica glass sand is sprinkled between the brick to keep them from adhering to each other at high temperatures. Every six courses a layer of old brick tile was set to bind them together and distribute the weight evenly. When kiln was filled to about 18″ to 24″ from the roof, the doors were bricked in and fires started promptly.

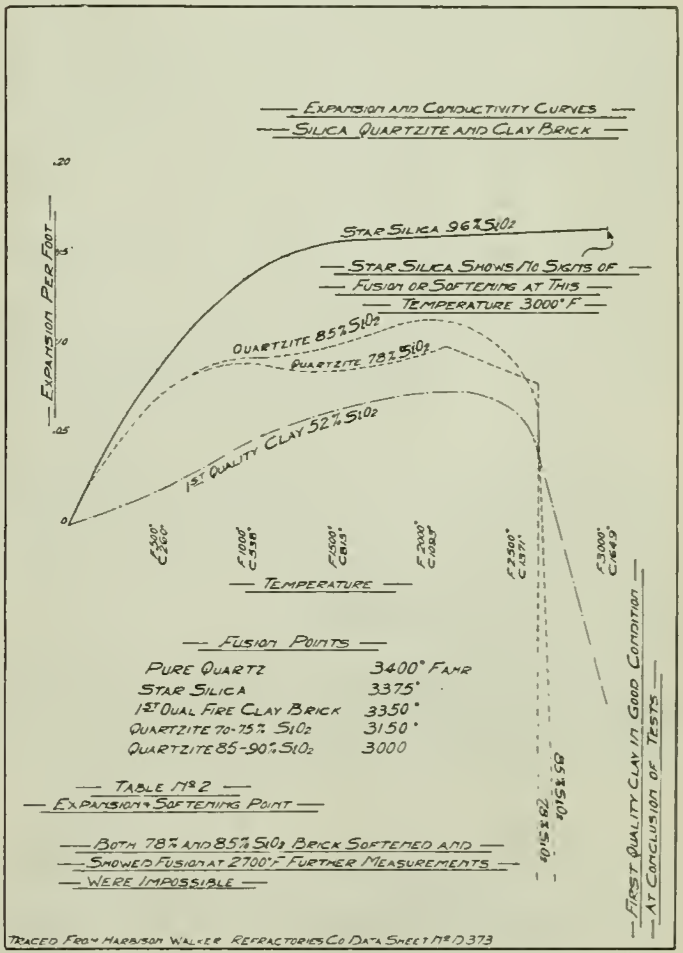
Burning

The operation of burning takes from 9 to 10 days and is divided into three periods —

(1) Dehydration
(2) Oxidation
(3) Vitrification

The first three days the fires were kept thin, allowing plenty of air to circulate through the kiln to carry off whatever moisture there might be in the brick, the temperature rising to about 300 degrees C. or 572 degrees F. In the second period, the fires were thickened and draft lessened from 4 mm to 3 mm — the temperature rising gradually to about 600 degrees C. or 1000 degrees F. on the 6th. day. In the last period, the fires were heaped up to the top of the doors and draft gradually lessened to 2 mm, the temperature being forced up to 1490 degrees C. or 2700 degrees F.

The temperatures were observed by means of Seager cones, set a few courses above the floor in the centre of the kiln, a small tunnel being built from them to a peek hole. The draft was



Analyses of Silica Brick

	Silica	Alumina	Ir. Ox.	Ca0	Mag.	Loss Ignition	Fusion
Aberdeen Brick	93.15–93.90	2.19–2.22	1.71–1.48	3.02–2.10	Trace	.13–.15	1710°C. or 3110°F.
Skye Mt. "	94.24–94.72	1.31–2.16	1.58–1.18	2.57–2.04	"	.10–Nil	1750°C. or 3182°F.
George's River Brick	95.08	1.84	1.23	2.10	"	.10	1750°C. or 3182°F.
Star (Harbison-Walker)	96.25	.88	.79	1.80	.14	.39	

controlled by a differential draft gauge set in the flue on the furnace side of the damper. As soon as cone 31 indicating 1490 degrees C. of temperature showed signs of bending, all four doors and ash pits were sealed with plates, cut to fit and plastered with clay all around. The kiln remained sealed for 12 hours, allowing the brick to soak. On the 10th. or 11th. day the plates were removed and several brick taken from the top of each door. The open spaces were gradually increased and damper opened, cooling taking about 3 days. Too rapid cooling will spall the brick and also make them spongy.

Bricks on being taken from the kiln appeared to be well vitrified strong mechanically and true to size. Sample brick were sent to the laboratory for analysis and determination of fusion point, the results of which are shown here, in comparison with the Standard Star silica brick of Harbison-Walker Refractories Company:—

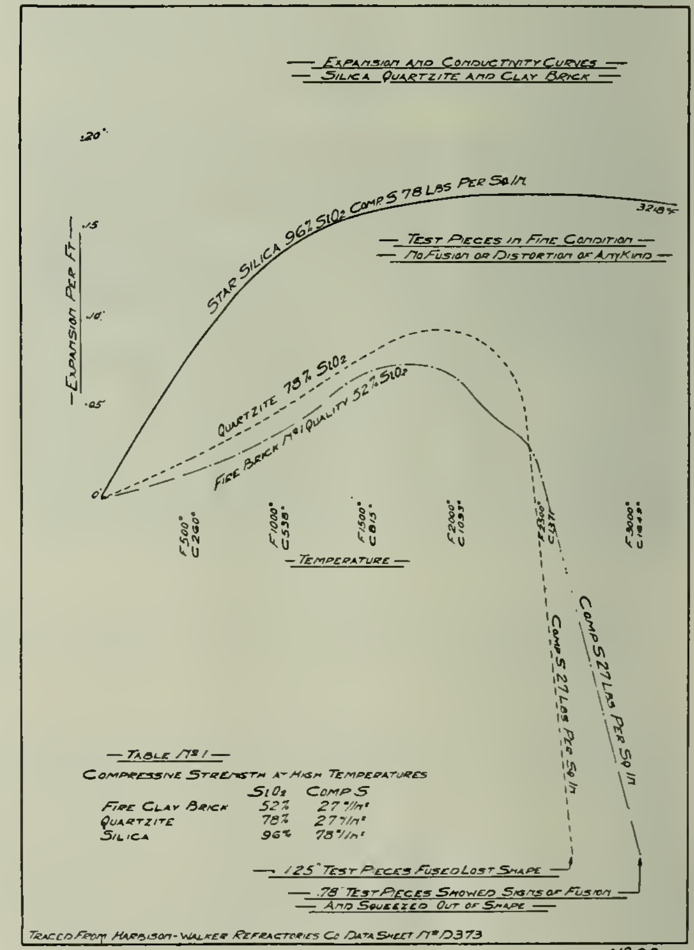
We planned to test the bricks under actual service conditions in our open hearth furnaces. This had to be done cautiously so as not to disturb operations — Our first test was made by building a section of the back of the bulkhead flue on one of the furnaces down for repairs. They stood the test well, so then a portion of one of the front piers was built with home-made brick,— this also proved satisfactory.

It was then decided to build the half of the front of three separate furnaces as they came off for repairs with the brick from Skye, Aberdeen and George's River, the results of these tests showed bricks — from

Aberdeen quartzite stood up in piers	59 heats
Skye " " " " " —	65 heats
Geo. River " " " " " —	70 heats

The average life of a front wall for the previous six months to our tests was 61 heats.

The cumulation of this work, which proved that suitable brick could be manufactured from local silica rock, has been the opening of a quarry at Leitche's Creek,



No 98

referred to before as George's River, and the erection of a plant capable of manufacturing 10,000 9" eq. per day of 10 hours.

Concurrently with silica brick experiments we carried on experiments in making clay brick with such gratifying results that it led to the establishment of a plant devoted to the manufacture of clay runner brick, using for bottom pouring the ingots for the plate mill. This plant has been in operation for a year and recently has also taken up the manufacture of ladle brick, which are superior to brick previously purchased, standing up to 20/22 heats in the ladle. This plant has a capacity of 10,000 9" eq. We have made about 200,000/250,0000 of these ladle bricks from

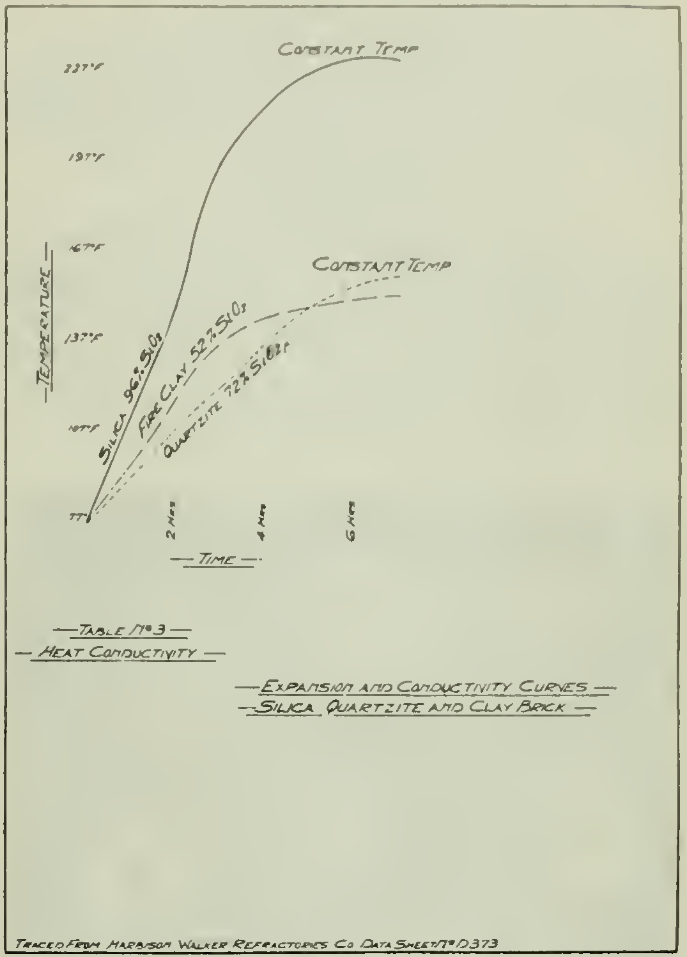
- 60% pit stone from No. 16 mine
- 25% grog
- 15% Mackay clay

The runner brick plant has made up to 7000 9" eq. per day. These brick being made of a mixture of

- 25% Mackay clay
- 75% grog

Machinery is being installed to manufacture runner brick and the output will be considerably larger when this is put into operation.

The cost of silica brick plant is about $250,000 and the quarry $50,000, a total sum of $300,000, the cost of runner brick and ladle brick being about $75,000.



No 100

The Cause and Prevention of Decay in Structural Timber

Fungus the cause of timber decay; factors influencing growth of fungus; methods for preventing decay and preserving timber.

R. J. Blair, Pathologist, Forest Products Laboratories of Canada.

Paper presented before Montreal Branch, The Engineerng Institute of Canada, February 3rd, 1921.

The economic losses which arise through the decay of structural timber amount to such a total as would astonish anyone who might be interested in the subject. More than fifty per cent of the railway ties in Canada are of hemlock and jack pine, and the average life of these ties is six or seven years. Fence posts, poles for telephone or telegraph lines and electric wires rot off at the surface of the ground; sidewalks and platforms which are near the soil are also subject to decay. Timbers in moist, unventilated basements last for only a few years and a very limited service is obtained from roof-timbers of such buildings as have a moist occupancy. Conditions have been studied at more than a hundred pulp and paper mills in Canada and the United States. The majority of these mills have wooden roof-decks, and of this number but a very few have had no trouble with decay in roof-timber. In fine textile mills a similar condition of affairs exists. In 1918 forty-seven acres of bad roof were found at twenty-four textile mills. More than fifty textile mills have been visited and but little difference has been noted in the service obtained from various types of wood roof-deck.

Timber decay has been looked upon as a mysterious calamity from which there is no escape. *It is time that the wood-using public realized that every bit of this trouble may be avoided. Long and satisfactory service may be obtained by using wood if it is handled with a knowledge of its inherent properties and of the agencies which bring about its deterioration.*

The Process of Decay

When a piece of wood decays it largely retains its original form but all the properties which make it useful disappear. The decayed wood is light in weight, has no strength and upon drying becomes brittle so that it may be easily crushed into powder.

Wood decay when first studied was supposed to be a process of oxidation similar to the rusting of iron. Various fungus growths were often found growing upon the disintegrating wood and it was supposed that this material furnished a suitable soil for the growth of the fungus plant. Later, when the habits of the fungi came to be studied, it was discovered that these plants are entirely responsible for all changes produced in wood as it passes from a sound to a decayed condition.

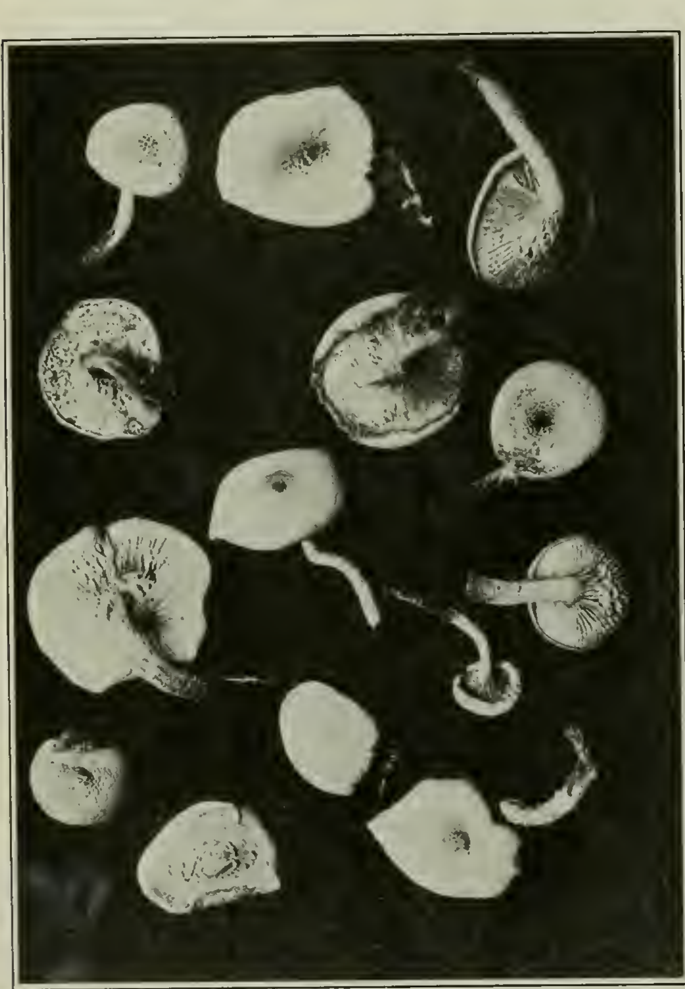


Fig. 1. Fungus fruiting-bodies collected on roof-planks of a Massachusetts cotton mill.

The Wood-Destroying Fungus Plant

Compared with any of the plants having green leaves a fungus is a simple organism. The active part of the fungus plant consists of a number of very fine hairlike filaments which penetrate the wood in all directions dissolving out parts of it (Fig. 2.) Under special conditions these filaments unite to form masses of plant tissue on the surface of the wood which are known as toadstools or fruiting-bodies (see Fig. 1) of the fungus. These growths correspond to the flower and fruit of any of the plants with green leaves and serve for the production of the spores. Spore is the name given to that which acts as a seed in the case of the fungus plant. The spores are so small that they are carried about by air currents and often reach the surface of a piece of wood. They are produced so abundantly that a sufficient number might be formed on a few fruiting-bodies to infect every piece of lumber stored in a large yard. When a fungus plant is well started in any piece of timber it is able to attack any uninfected timber with which it is in contact.

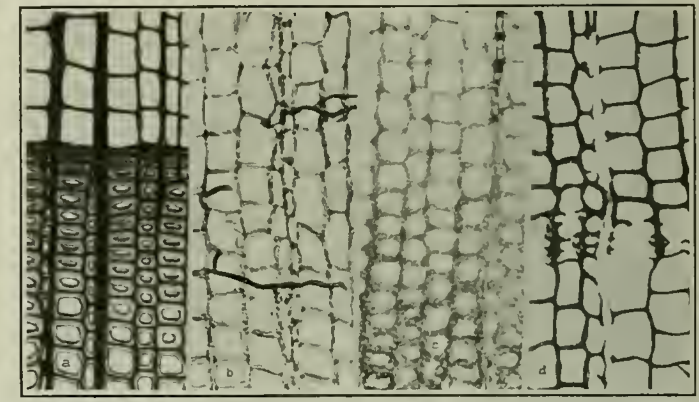


Fig. 2. Transverse sections of hemlock wood magnified 125 times. The white background represents the air spaces within the hollow wood-fibres; a, normal sound wood; b, fungus filaments in decaying wood; c, dots represent passages formed by fungus filaments in walls of the wood fibres; d, places where wood fibres have been removed by the action of the fungus. Photomicrographs by W. B. Stckes, preparations by H. N. Lee.

Moisture Requirements of the Fungus Plant

Considered by itself the spore is a small delicate body. In order to grow when it has come to rest on the surface of a piece of wood there must be sufficient moisture for it to germinate and get a start.

Adequate moisture in the immediate neighbourhood of the spore is the one condition which allows it to germinate. Moisture in the wood afterwards is the one condition which permits the fungus plant to continue growing, and provided the wood is properly moist during a prolonged interval, the fungus continues its activity until the wood has been destroyed. In a healthy tree it is considered that the wood is entirely free from all fungus, but when the trunk has been sawn up and stored for a short time under average lumber-yard conditions, it seems safe to assume that a few spores of some fungus plant have reached and infected practically every piece of material obtained.

Moisture is Present in Wood Which Decays

In structural timber the presence of the moisture which allows the fungus plant to cause decay may be accounted for in various ways. The wood of the living tree contains a varying amount of moisture which at times is more than equal to the weight of the wood itself. When the tree is cut the moisture begins to leave the wood and this action continues until the wood has reached what is known as an air-dry condition. The rate at which the moisture loss takes place depends on the size of the pieces and the dryness of the surrounding air. In its air-dry condition wood may contain in moisture any amount up to 30 per cent of the weight of the wood when bone-dry. As wood is hygroscopic its moisture content varies with the relative humidity of the air surrounding it and it is able to come to a condition of equilibrium with its surroundings.

The moisture condition of wood thus depends upon the relative humidity of the air to which it is exposed. The exact degree of humidity which permits of a moisture content sufficient to allow fungus growth is not known, but any wood constantly exposed to a humidity of more than 70 per cent is very apt to be attacked by decay. Under such conditions wood which is at all moist has so little opportunity to dry out that it may decay within a very short time. When logs are sawn up, all material, especially the timbers of large dimensions, should be given a good opportunity to season if trouble is to be avoided.

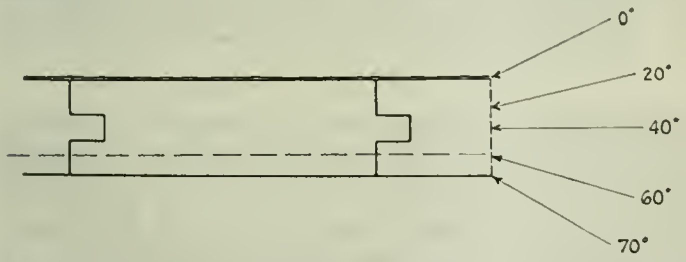


Fig. 3. Conditions to which the roof-deck of a building with a moist occupancy is ordinarily exposed. Outdoor temperature is 0 °F., the air in the building at 70 °F. with relative humidity of 70 percent. The dew-point of this air is 59. 2°. The broken line represents the plane above which air whether in spaces between the planks or natural openings in the wood is saturated with moisture some of which has condensed.

In mill buildings with a moist occupancy, the air may constantly remain at 70 per cent relative humidity at a temperature which is comfortable for workmen. If the thermometer registers 70 degrees, a drop in temperature of 11 degrees cools such air below its dew-point and some of the moisture collects in drops of water. When such water collects on wood, it soaks into it and keeps it moist so that decay results. Sufficient cooling to bring about condensation takes place very readily in cold weather and it is very essential that the heating system be adequate and arranged to distribute the heat uniformly. Otherwise moisture is readily condensed at such places as are insufficiently heated. Condensation takes place in the same way in the interior and upper layers of roof-decks and brings about a rapid deterioration of the planking. Conditions in moist basements are similar to those found in mills except that the basements are usually unheated so that moisture condensation takes place readily when the weather is cold. Wood in contact with the soil invariably takes in sufficient moisture to permit of fungus growth.

Wood Preservation as a Means of Preventing Decay

It may be clearly seen that in order to protect timber from decay it is necessary to prevent the growth of the wood-destroying fungus. Either of two methods may be made use of. The fungus plant may be starved by keeping away from it the moisture which it requires for its normal development or it may be poisoned by treating the wood with a preservative.

When used in places where it cannot remain dry such as in contact with the soil or in moist situations, fungus growth can be prevented only by using a preservative on the wood. This means that a poisonous material is placed in the wood in such a manner that any fungus plant present is killed and other fungus plants are prevented from attacking the wood. The preservatives commonly used are creosote oils and water-soluble chemicals such as zinc chloride, mercuric chloride and sodium fluoride. *Efficient preservative treatment means that the preserving substance reaches and kills the fungus plant no matter how deeply it may have penetrated the wood. A preservative treatment would be unnecessary in any timber used in a place where it remains dry.*

Prevention of Decay by Shutting off the Moisture Requirements of the Fungus

For protecting timbers in buildings a choice of various methods of moisture control may often be made. Trouble may arise in two types of building, namely unheated warehouses and mill buildings where the occupancy is moist, such as pulp and paper mills, cotton mills, dye-houses, bleacheries, canneries, etc.

Only thoroughly seasoned timbers should be used for the construction of an unheated warehouse. Trouble easily arises from neglecting this fact in the laminated type of floors where a large mass of timber has little opportunity to dry out. In any building containing large timbers, the heating system should be installed as soon as possible and put into operation for several days in order to dry out surplus moisture in any of the timbers. This is specially necessary in buildings where the wood gets wet during construction. In unheated buildings temporary heating systems should be installed to dry out the timber thoroughly in every case where it is known that the timbers are wet or green. A coat of paint may retard drying out of the timber and for this reason painting or covering the surface in any way should be delayed until all timbers have been given opporantunity to season thoroughly.

Timber exposed to the air of moist basements in some cases may be protected by opening windows to give natural ventilation. Such ventilation is an advantage only when it lowers the relative humidity of the basement air. In a basement of a very large building, or of buildings which are surrounded by other buildings, it may be necessary to lower the humidity of the air by the installation of a heating system consisting of one or two steam pipes. In two mills this has taken place with good results.

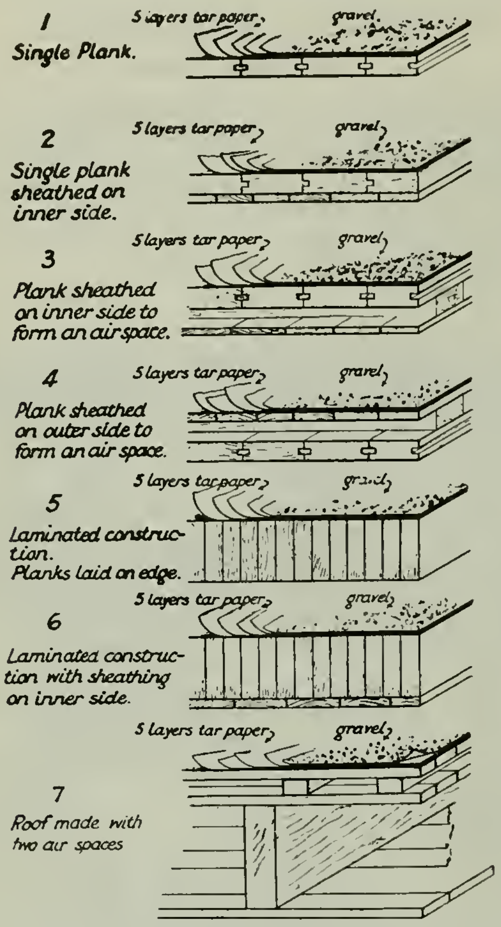

1
Single Plank.
5 layers tar paper
gravel
2
Single plank sheathed on inner side.
5 layers tar paper
gravel
3
Plank sheathed on inner side to form an air space.
5 layers tar paper
gravel
4
Plank sheathed on outer side to form an air space.
5 layers tar paper
gravel
5
Laminated construction. Planks laid on edge.
5 layers tar paper
gravel
6
Laminated construction with sheathing on inner side.
5 layers tar paper
gravel
7
Roof made with two air spaces
5 layers tar paper
gravel

Fig. 4. Types of wood roof-deck in common use. Moisture condensation readily occurs in the upper level of all these types of construction and produces decay in the timber.

Roof-deck timber forms a particularly interesting field for the study of the control of moisture conditions. Moisture condensation on mill roofs is a problem in itself which calls for attention, and when this moisture permits decay in the wood roof-deck the subject assumes an added importance. In mills where the moisture comes from drying processes adequate and efficient ventilating systems take care of the greater part of the trouble.

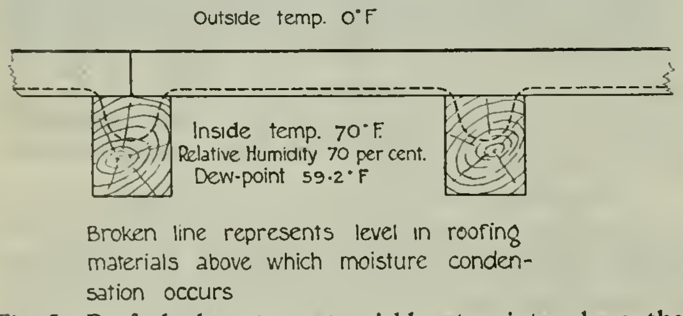

Outside temp. 0°F
Inside temp. 70°F
Relative Humidity 70 per cent.
Dew-point 59.2°F
Broken line represents level in roofing materials above which moisture condensation occurs

Fig. 5. Roof-planks rot most quickly at points where they are supported.

In spinning mills and weaving rooms, it is often necessary to maintain very humid conditions all the time, and the roof-deck requirements of such buildings can be satisfied only by a type of construction which eliminates the problem of moisture condensation entirely. For meeting climatic conditions such as are commonly found in Canada, a type of double roof-deck must be adopted. The extra thickness reduces heat loss and prevents the condensation of moisture. Western red cedar is recommended for the roof-deck proper as this wood is naturally more resistant to decay than that of other species found in Canada. This wood possesses several distinct advantages such as lightness in weight, low thermal conductivity, a good surface to receive paint, uniform quality and it is available in large quantities. The edges of the timbers supporting the roof-deck should be chamfered off so that the part of the plank directly supported may remain unaffected by moisture. A layer, consisting of a cheap grade of lumber treated with a preservative should be placed upon the roof-deck for purposes of heat insulation. The two layers of plank should be separated by a moisture-proof layer consisting of three plies of mopped tar paper.

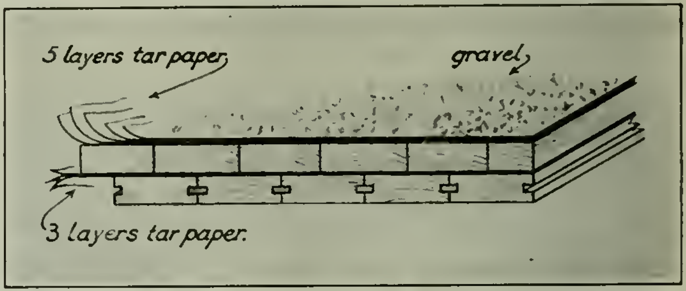


Fig. 6. Good roof-deck construction which is two planks in thickness. The inner layer is made of Western Red Cedar, a decay-resisting wood. The outer layer consists of lumber of an inferior kind treated with a preservative. Three plies of mopped tar paper separate the layers of plank and prevent moisture condensation in the colder part of the roof-deck.

Summary

1. All users of structural timber are subject to loss through timber decay.
2. Timber decay results from the attack of a wood-destroying fungus.
3. The fungus is a common plant which requires moisture in order to grow.
4. Only such wood as is properly moist offers an attractive location for the fungus plant.
5. The development of fungi may be avoided either by keeping the wood dry and thus withholding the moisture required by them or else by using a wood-preservative which acts as a poison and prevents their growth.
6. In practice all wood exposed to the weather, in contact with the soil or in moist situations should be given preservative treatment while in buildings the moisture relations necessary for fungus growth may be controlled by the installation of efficient heating and ventilating equipment.

The Metric System of Weights and Measures

Advantages of the system, legal problems, transition steps.

David A. Molitor, M.E.I.C.

Paper presented before Border Cities Branch, The Engineering Institute of Canada, April 9th, 1921.

At this time of world reorganization, the universal adoption of a uniform system of weights and measures becomes one of the most important issues of the day.

Every reform movement, and every institution under which we live and of which we are justly proud, originally came into being through the labours of minorities. Although majority rule is being recognized as the cornerstone of democratic government, it is wise to remember that even a democracy despises minorities at its peril.

The recent world strife, whatever its immediate causes may have been, undoubtedly originated in the race for trade supremacy in which the metric nations gradually displaced their non-metric rivals England and the United States.

With these preliminary remarks we may safely assume that our subject is presently entitled to the fullest consideration and widest publicity. If we can disprove the arguments which certain anti-metric propagandists would have one believe, then in fairness to ourselves, our country, and our progeny, let us now apply our best efforts to the furtherance of this great reform.

Description of the Metric System

The U.S. Bureau of Standards is the custodian of the duplicate platinum-iridium metre bars and kilograms weights furnished to the American government in 1899, by the International Bureau of Weights and Measures. These serve as the fundamental standards of length and weight for all units of measurement in the U.S.

The fundamental unit of the metric system is the *metre* which is the unit of length and is equal to 39.37 inches. The units of weight and of capacity were derived from the metre and are known respectively as the *gram* and the *litre*. All other units are decimal subdivisions or multiples of these three. The units of length, volume, weight and capacity are conveniently interrelated as follows: One cubic decimetre of water at 40° centigrade, equals one litre and weighs one kilogram, or, one cubic metre of water measures 1000 litres (1 kilolitre), and weighs 1000 kilograms or one metric ton.

Corresponding relations between the units employed in the United States and in Canada, would be as follows: 1 cu. ft. water = 7.480-U.S. gallons = 6.231 = Imp. gallons = 62.42 lbs. avoir. 1 U.S. quart water = 57.75 cu. in. and weighs 2.083 lbs. avoir at 35.8° F. 1 Imp. quart water = 69.325 cu. in. and weighs 2.5 lbs. avoir. 1 U.S. dry quart = 67.2 cu. in. and 1 Imp. dry quart = 69.32 cu. in. Besides these units there are three different kinds of weights in the U.S. and two in Canada.

The metric mensuration tables are formed by combining the words metre, litre and gram with the six numerical prefixes as in the following table.

Prefixes	Meaning	Length units	Capacity units	Weight units.
1. kilo—	1000	1 km = 10 hm	1 kl = 10 hl	1 kg = 10 hg
2. hecto—	100	1 hm = 10 dkm	1 hl = 10 dkl	1 hg = 10 dkg
3. deka—	10	1 dkm = 10 m	1 dkl = 10 l	1 dkg = 10 g
unit—	1	1 m = 10 dm	1 l = 10 dl	1 g = 10 dg
4. deci—	1-10	1 dm = 10 cm	1 dl = 10 cl	1 dg = 10 cg
5. centi—	1-100	1 cm = 10 mm	1 cl = 10 ml	1 cg = 10 mg
6. milli—	1-1000			

The square measure is derived from the length measure by substituting 100 for 10 in the column of length units and employing the additional designation "square". Similarly for cubic measure where the relationship becomes thousand fold.

For land measure, the unit is the ar = 100 sq. metres, and this unit may be combined with the above six prefixes to obtain the complete mensuration table. This spelling is preferable to the french *are* to avoid confusion with the English verb of same spelling.

The various decimal multiples and subdivisions of the metric units have received names merely for convenience and completeness of the system.

The general public would employ only a few of the metric units for commercial uses. The kilometre and metre are the common units of length, used exactly as we now use the mile and yard. The kilogram is the usual unit of weight, although the half kilogram is frequently called a pound. The litre is the unit for liquid measure and the ar for land measure. Thus we would have kilometres, metres, kilograms, litres, ars, and cubic metres corresponding respectively to our terms miles, yards, pounds, quarts, acres, and cubic yards.

The metric system is so simple in theory and practice that any one of average intelligence can learn it in one hour. In a few days it is as easy to think in this system as in our own. Estimating is facilitated by remembering that the metre, litre, half-kilogram and metric ton are each about 10% larger than the corresponding British units yard, dry quart, pound and short ton. The U.S. liquid quart is about 5% smaller, and the Imp. quart about 13.5% larger than the litre. For accurate conversions between metric and American units, circular No. 47, of the U.S. Bureau of Standards should be used.

Legal Status of the System in the World.

The metric system is obligatory in the following 35 countries having a total population of over 437 million: Argentina, Austria, Belgium, Brazil, Bulgaria, Chili, Columbia, Congo, Costa Rica, Cuba, Denmark, Finland, France and colonies, Germany, Guatemala, Holland and colonies, Honduras, Hungary, Italy, Luxembourg, Mexico, Nicaragua, Norway, Peru, Portugal and colonies, Roumania, Salvador, Servia, Siam, Spain, Sweden, Switzerland, Tunis, Turkey and Uruguay.

The Japanese Parliament recently voted a law making the metric system obligatory, the law to go into effect in April, 1922. In China the system will come into force in 1923. In Russia the system has been taught in all schools for many years, and since the war it is the standard for commercial transactions.

The metric system is legal but not obligatory in the following eight countries: Bolivia, Canada, Egypt, Great Britain, Greece, Paraguay, United States and Venezuela.

This brings the total, which may be classed as pro-metric, to over 800 million people, exclusive of the eight countries where the system is merely legal.

The British attitude is indicated by the fact that in 1897 the metric system was made legal and in 1900 there were 96 members of Parliament in favor of a compulsory metric bill. In 1906 the metric votes increased to 44, while in 1907, the bill lacked only a few votes of passing. The governments of Australia, Canada, South Africa and New Zealand have declared themselves strongly in favour of the reform.

To summarize the facts it appears that the whole world is practically metric excepting only the British Empire and the United States. These two powers are now seriously considering compulsory adoption, thus fully admitting the failure of permissive legislation.

Legal Status of the System in America

To a certain extent the metric system is the adopted standard of the United States and Canada because most of the American standards are at present derived from the metric, and all electric units and the coinage are entirely metric.

The right to establish a system of weights and measures is vested in Congress by the Constitution of the United States, but aside from legalizing the system by the act of 1866, that authority was exercised only with respect to the coinage, electric units, and postal rates, and in making the system obligatory in Porto Rico in 1899 and in the Philippine Islands in 1901.

Objections to the Adoption of the Metric System

1. Expense and inconvenience attending any change in our present units of measurements.

2. One additional system. It is claimed that the adoption of the metric system would mean simply adding one more system to the many already in use. This is precisely the condition which has prevailed for many years under permissive laws and which it is so desirable to overcome by the adoption of one system which will fulfill all human requirements.

Reasons for the Adoption of the Metric System

1. Simplicity of the relations existing between the units of length, area, volume and weight. This obviates effectually all the laborious manipulations growing out of complex relations, and saves an immeasurable amount of time and labour in all scientific and commercial pursuits.

2. Uniformity of all units of measurements throughout the world, following the adoption of the system by Great Britain and the U.S. This feature is specially calculated to facilitate international commercial relations, so vital to our manufacturing industries.

3. International standard. The unalterable and perfect prototype standards which exist in all civilized countries, make it the accepted standard for the world.

4. One mensuration table would answer all purposes in all walks of life, and in every nation on the earth, instead of the thousands of units which are or have been in use during past ages. School children would have to learn only one set of units, which would carry them through life, instead of the many complex mensuration tables which they must now memorize.

5. The decimal relation between the metric units offers an inestimable advantage in all scientific work and the arts.

The Metric System in Export Trade

It is a universally acknowledged principle of trade, that the purchaser reserves to himself the right to stipulate what he wants and when he wants it. The salesman must meet these requirements or lose the business.

We have all observed the results of overproduction, and periods of glutted market, which are bound to return. Whom we do expect to serve with the enormous output of this country in ever increasing excess over home demands or consumption? Aside from English customers, they will all be from metric countries.

Germany adopted the metric system in 1872 after her military victory over France, and thereby laid the foundation for her later commercial victory. Shall we heed or ignore this lesson at the present turning point in international reorganization?

Most people believe that the United States has a community of interest with England against the metric world. This is true only in name while the fact is that England long ago abandoned the troy pound, and the U.S. is still using a gallon and a bushel measure long since discarded by England, so that with respect to all liquid and dry measures and the ton weight, the U.S. practice already differs widely from the English. The further fact that British exporters are using the metric system very extensively is an equally cogent reason why American exporters should do the same

Where commercial relations with foreign countries bring about conflicting conditions, a dualism of units seems a necessary but temporary evil. Thus, where raw products are so largely furnished by America and England and the manufactured products from France, Switzerland, Germany, etc. are sold back to the former, such a condition will continue to exist until the metric system becomes universal.

Many commercial interests involved in foreign trade are now supplying catalogues and handbooks in which equivalents are given in both metric and British or

U.S. units, indicating that the metric system is being extensively used in reaching out after foreign trade. Strangely enough most of these catalogues emanate from precisely those mechanical trades which formerly waged the most strenuous opposition to the metric reform. The mere fact that such concerns have entered upon metric manufacture and trade, proves that this is both possible and profitable.

Of all comparatively recent cases, where manufacturing concerns have boldly plunged into metric units to save themselves from partial or entire elimination from export trade to metric countries, few, if any, have regretted the step. Recent reports show that a host of British manufacturers have voluntarily adopted the metric system.

In 1907, the Baldwin Locomotive works built twenty locomotives from metric drawings for the French government. This experiment developed such satisfactory results that during the war the same concern built 100 more locomotives to metric dimensions.

Transition Problems

To remove the apprehensions of objectors who claim that the cost of making the change would be very severe particularly on manufacturers of tools and machinery, it is merely necessary to point out that metric legislation, in practically every country and as proposed for Great Britain and the United States, is only concerned with transactions of sale, while manufacturers are free to use any system they desire in their workshops. However, the adoption of the new weights and measures in commerce will make it possible for any manufacturer to operate his workshop metrically, whenever he finds it to his own interest to change over.

Where it becomes desirable to translate English to metric units in trade catalogues or on drawings by the use of conversion tables or otherwise, it should be remembered that every weight or dimension is to a certain extent nominal, so that a definite tolerance is permissible in every case. For example, where dimensions are given to the nearest 1-32 or 1-25 inch, the metric equivalent should be expressed in whole millimeters, thus 2-1/32 inches = 51mm. On the other hand, where a high degree of accuracy is necessary and ten-thousandths of an inch are called for, the metric size should be stated to the nearest 0.01 mm., thus 1.2487 inches = 31.72 mm.

In many cases gauges are designated by abstract numbers as for wire, sheet metal, screws, etc. Here the number governs the size irrespective of any particular unit of length. There are at least five different wire and sheet metal gauges which it would be a blessing to see replaced by one rational metric gauge.

A pattern or template always retains its value, whether it was made to inches or to millimetres, and when the dimensions on a drawing are once converted the difficulty is overcome without changing the thing itself.

Regarding structural shapes and plate thicknesses, the metric scale in millimetres without decimals answers every purpose since the usual tolerance for mill variations is at least 1-32 inch. In like manner, tables of round, square and other rolled shapes, also pipe sizes, can all be expressed in whole millimetres and be within actual trade limits so that the change would be one of name only. Rolling mill machinery would all be usable until worn out and slight changes could easily be made at appropriate times. In fact as early as 1906, several German, French and Belgian rolling mills manufactured rails and structural shapes of American standard sections and quality, hence it should be equally feasible for American mills to roll metric sizes without change in present equipment.

In machine shop practice, designs are changed at such frequent intervals that dimensions could be easily converted or altered without extra expense. In many cases certain sizes and types of machines are arbitrarily discontinued or repair parts are no longer procurable, so that new machines must be purchased. Perfectly good machines are often discarded as a matter of efficiency owing to newer and better types being produced. Hence little, if any, pecuniary loss to manufacturing concerns need be incurred directly as a result of the change to metric sizes.

There are reasonable objections to any sudden changes in screw threads and it may require several years before the British threads can be displaced. Some American catalogues give eight systems of screw threads, including three metric and five non-metric systems, showing how desirable it would be to abolish some of them. The British threads remained standard in France and Germany until about 1900 at which time the metric thread was officially established. In the course of nine years the new metric thread became the most extensively used in the mechanical industries of continental Europe. Metric taps and dies are already offered for sale by a number of prominent American manufacturers and can be acquired without extra cost whenever replacements become desirable. Screw cutting lathes can be easily rigged to cut metric threads merely by the introduction of a special gear.

The present divisions of the circle are already universal and hence require no change. The decimal quadrant affords no advantage because all mathematical processes involving angular functions must be solved by logarithms or natural trigonometric functions.

All surveying instruments will thus remain unaffected. The cheaper accessories like levelling rods, tapes, and scales, which wear out with sufficient frequency, can be replaced by metric tools whenever desirable.

Ordinary weighing scales can be altered to weigh metrically either by changing the graduated limbs or by supplying different counterweights. In the better class of computing scales the only change necessary would be to supply a new printed diagram. Chemical scales are practically all metric at the present time because no chemist could well afford to calculate analytical results in apothecary weights.

Leather measuring machines which are quite costly affairs, can be altered to measure metrically simply by replacing the dial. A convenient metric unit for measuring leather is the cuirmeter, which is 1-10 sq. meter or 1.076 sq. ft.

Drawings made to metric scales always bear a simple ratio to actual sizes. Common ratios are 1:2, 1:5, 1:10, 1:20, 1:25, 1:50 and 1:100. Ratios differing by multiples of ten are all taken from the same graduation. About six different graduations will supply practically all scales in use.

In the publication of new books it is almost necessary to supply both English and metric data at the present time. Older books can be changed when revisions become necessary.

It is a fact that, during the past hundred years, every nation which changed its system of weights and measures adopted no other system than the metric, and no non-metric country is at present contemplating any change other than to the metric system.

The exclusive use of the metric system must be regarded as a step toward national economy which no good citizen can afford to oppose.

"No doubt the initial institution of the decimal system would cause dislocation, but once established the saving of time and labor could not fail to bring rapid compensation."

Hon. Reginald McKenna.

In speaking of the metric system, Theodore Roosevelt said: "We must have it."

Required Legislation.

Much has been said and written to prove the fallacy of permissive laws, though the enactment of this class of legislation appears to be the fullest extent to which our legislators will assume responsibility.

The general presumption that people have a right to do anything which is not forbidden, would naturally mean the uselessness of all laws which merely permitted. In other words, it is folly to pass laws to permit people to do something as a matter of convenience to themselves.

Great Britain has suffered over 20 years and the United States about 50 years under such laws.

A mere authorization to employ a simple and rational system of measurements as a substitute for a much less perfect system long established by usage, is not sufficient to bring about a reform. In fact, in commercial affairs, the buyers and sellers are dependent one upon the other in such a manner, that unless one side completely dominates the situation, neither is able to take the initiative toward the adoption of the improved standards. It is necessary, therefore, to make the new measures obligatory.

Aside from a slight temporary inconvenience to shop keepers, it will be in every case merely a matter of price, and those having goods for sale will very soon adjust the scale of prices.

Who would return to the English monetary system after having used decimal money? What metric country in all the world would be willing to give up the metric system after having experienced the great advantages accruing from its adoption?

It is a great mistake to agitate in favour of a long transition period. This would mean a long period of watchful waiting with the outcome that nobody would do anything toward adopting the new system until the time fixed had expired. Such a law would be forgotten before it ever became operative. The U. S. government had this experience when the railroads were ordered to equip all freight cars with automatic couplers and continuous brakes. The railroads did nothing toward complying with the law until the allotted five years had expired. The time was then extended two years and seven months, during the last year of which most cars were equipped.

The fact that in private enterprises, both in England and in America, many have availed themselves of the great advantages accruing from the use of the metric system should be a sufficient rejoinder to any objection on the basis of cost. Private enterprise does not plunge heedlessly into such ventures unless it is a paying investment.

Hence, we are not praying for today, or for a group here and there; but what we hope to achieve is calculated to benefit untold millions in the years to come.

Annual

Meeting

Announcement

The annual general meeting of *The Engineering Institute of Canada* will be held at Montreal on Tuesday, January 24th, 1922, at ten o'clock A.M.

At this meeting the formal business of the annual general meeting will be presented. The agenda will consist for the most part of appointments of scrutineers; appointment of auditors; reception of reports, (a) report of Council, (b) reports of committees, (c) reports of Branches; new business; reports of scrutineers announcing election of officers.

The meeting will be adjourned to Winnipeg, **February 21st, 22nd and 23rd**, where unfinished business of the annual meeting will be continued and the annual general professional meeting will be held under the auspices of the Winnipeg Branch. The programme of the professional meeting, details of which will be announced later, is at present under consideration by the Winnipeg Branch.

The Winnipeg Branch anticipates, and is providing for a large attendance and it is sincerely hoped that many members both East and West of Manitoba will plan to be present. It is expected that special arrangement will be made for a train from the East and possibly from the West coast, for those attending the meeting.

THE JOURNAL OF
THE ENGINEERING INSTITUTE
OF CANADA

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Nominations for Officers' Ballot

Within seven days after the first meeting of the Council in October, the Secretary shall mail to each corporate member of The Institute the officers' ballot, as prepared by the Nominating Committee and the Council.

Notices shall be deemed to have been mailed to members as prescribed by the By-Laws if such notices are printed in The Journal of the Institute and mailed by the dates prescribed in the By-Laws.

The following is a list of the nominees submitted by the Nominating Committee, as required by the By-Laws before the first day of October and as approved by Council at the regular meeting of Council held on October thirty-first:-

President: J. S. Sullivan, M.E.I.C., Winnipeg.

Vice-Presidents: G. Gordon Gale, M.E.I.C., Ottawa; C. C. Kirby, M.E.I.C., St. John; Brig.-Gen. C. H. Mitchell, M.E.I.C., Toronto; Arthur Surveyer, M.E.I.C., Montreal.

Councillors:

District No. 1: Lt.-Col. A. E. Dubuc, M.E.I.C., Montreal; J. A. Duchastel, M.E.I.C., Montreal; J. H. Hunter, A.M.E.I.C., Montreal; Geo. MacLeod, M.E.I.C., Montreal.

District No. 2: J. E. Gibault, A.M.E.I.C., Levis; J. F. Grenon, A.M.E.I.C., Chicoutimi.

District No. 3: C. M. Odell, M.E.I.C., Glace Bay; A. F. Stewart, M.E.I.C., Moncton.

District No. 4: Lt.-Col. Alexander Macphail, M.E.I.C., Kingston; Lt.-Col. W. P. Wilgar, M.E.I.C., Kingston.

District No. 5: A. H. Harkness, M.E.I.C., R. O. Wynne-Roberts, M.E.I.C., Toronto.

District No. 6: G. H. Kohl, A.M.E.I.C., Sault Ste Marie; C. H. E. Rounthwaite, A.M.E.I.C., Sault Ste Marie

District No. 7: M. A. Lyons, A.M.E.I.C., Winnipeg; D. R. Ross, M.E.I.C., Winnipeg.

District No. 8: A. R. Greig, M.E.I.C., Saskatoon: Geo. D. Mackie, M.E.I.C., Moose Jaw.

District No. 9: A. W. Haddow, A.M.E.I.C., Edmonton; R. S. L. Wilson, A.M.E.I.C., Edmonton.

District No. 10: Ernest Davis, M.E.I.C., Victoria; Major G. A. Walkem, M.E.I.C., Vancouver.

St. Mary and Milk Rivers' Apportionment

In view of the interest which this subject has for a large number of our members, and following so closely upon the resolution of the Western Professional Meeting asking the Government for a speedy settlement, it is gratifying to be able to publish herewith the orders of the International Joint Commission, C. A. Magrath, M.E.I.C. Chairman, and particularly that of October 4th in regard to the division of the waters of the St. Mary and Milk Rivers and of October 6th regarding reservoirs in the United States and Canada. These have recently been received from the Secretary of the International Joint Commission, Lawrence J. Burpee, M.E.I.C., and are official.

International Joint Commission

In the matter of the measurement and apportionment of the waters of the St. Mary and Milk Rivers and their tributaries in the State of Montana and the Provinces of Alberta and Saskatchewan

Whereas by Article VI of the Treaty entered into between the United States of America and His Majesty, the King of the United Kingdom of Great Britain and Ireland and of the British Dominions beyond the Seas, Emperor of India, signed at Washington on the 11th of January, 1909, it is provided as follows:—

"The High Contracting Parties agree that the St. Mary and Milk Rivers and their tributaries (in the State of Montana and the Provinces of Alberta and Saskatchewan) are to be treated as one stream for the purposes of irrigation and power, and the waters thereof shall be apportioned equally between the two countries, but in making such equal apportionment more than half may be taken from one river and less than half from the other by either country so as to afford a more beneficial use to each. It is further agreed that in the division of such waters during the irrigation season, between the 1st of April and 31st of October, inclusive, annually, the United States is entitled to a prior appropriation of 500 cubic feet per second of the waters of the Milk River, or so much of such amount as constitutes three-fourths of its natural flow, and that Canada is entitled to a prior appropriation of 500 cubic feet per second of the flow of St. Mary River, or so much of such amount as constitutes three-fourths of its natural flow.

"The channel of the Milk River in Canada may be used at the convenience of the United States for the conveyance, while passing through Canadian territory, of waters diverted from the St. Mary River. The provisions of Article II of this Treaty shall apply to any injury resulting to property in Canada from the conveyance of such waters through the Milk River.

"The measurement and apportionment of the water to be used by each country shall from time to time be made jointly by the properly constituted reclamation officers of the United States and the properly constituted irrigation officers of His Majesty under the direction of the International Joint Commission."

And whereas the said Reclamation and Irrigation Officers have been unable to agree as to the manner in which the waters mentioned in the said Article VI should be measured and apportioned;

And whereas, before giving directions as to the measurement and apportionment of the said waters, the International Joint Commission deemed it proper to hear such representations and suggestions thereon as the Governments of the United States and Canada, the Provinces of Alberta and Saskatchewan and the State of Montana, and as corporations and persons interested might see fit to make and for such purposes sittings of the Commission were held at the following times and places:—At the City of St. Paul, in the State of Minnesota, on the 24th, 25th, 26th, 27th, and 28th days of May, 1915; at the city of Detroit, in the State of Michigan, on the 15th, 16th and 17th days of May, 1917; at the City of Ottawa, in the Province of Ontario, on the 3rd, 4th and 5th days of May, 1920; at the Village of Chinook, in the State of Montana, on the 15th day of September, 1921, and at the City of Lethbridge, in the Province of Alberta, on the 17th day of September, 1921, when counsel and representatives of the said Governments, corporations and persons appeared and presented their views;

And whereas pending final decision as to the proper method of measuring and apportioning said waters interim orders with reference thereto have been made by the International Joint Commission from time to time, the last of such orders bearing the date the 6th day of April, 1921;

And whereas the Members of the International Joint Commission have unanimously determined that the said Reclamation and Irrigation Officers should be guided in the measurement and apportionment of said waters by the directions and instructions hereinafter set forth;

It is therefore ordered and directed by the Commission in pursuance of the powers conferred by the said Article VI of the said Treaty that the Reclamation and Irrigation Officers of the United States and Canada shall, until this order is varied, modified or withdrawn by the Commission, make jointly the measurement and apportionment of the water to be used by the United States and Canada in accordance with the following rules:—

I

St. Mary River

(a) During the irrigation season when the natural flow of the St. Mary River at the point where it crosses the international boundary is six hundred and sixty-six (666) cubic feet per second or less Canada shall be entitled to three-fourths and the United States to one-fourth of such flow.

(b) During the irrigation season when the natural flow of the St. Mary River at the point where it crosses the international boundary is more than six hundred and sixty-six (666) cubic feet per second Canada shall be entitled to a prior appropriation of five hundred (500) cubic feet per second and the excess over six hundred and sixty-six (666) cubic feet per second shall be divided equally between the two countries.

(c) During the non-irrigation season the natural flow of the St. Mary River at the point where it crosses the international boundary shall be divided equally between the two countries.

II

Milk River

(a) During the irrigation season when the natural flow of the Milk River at the point where it crosses the international boundary for the last time (commonly and hereafter called the Eastern Crossing) is six hundred and sixty-six (666) cubic feet per second or less, the United States shall be entitled to three-fourths and Canada to one-fourth of such natural flow.

(b) During the irrigation season when the natural flow of the Milk River at the Eastern Crossing is more than six hundred and sixty-six (666) cubic feet per second the United States shall be entitled to a prior appropriation of five hundred (500) cubic feet per second and the excess over six hundred and sixty-six (666) cubic feet per second shall be divided equally between the two countries.

(c) During the non-irrigation season the natural flow of the Milk River at the Eastern Crossing shall be divided equally between the two countries.

III

Eastern tributaries of Milk River

The natural flow of the Eastern (otherwise known as the Saskatchewan or Northern) tributaries of the Milk River at the points where they cross the international boundary shall be divided equally between the two countries.

IV

Waters not naturally crossing the boundary

Each country shall be apportioned such waters of the said Rivers and of any tributaries thereof as rise in that country but do not naturally flow across the international boundary.

V

For the purpose of carrying out the apportionment directed in paragraphs I, II and III hereof the said Reclamation and Irrigation Officers shall jointly take steps

(a) To ascertain and keep a daily record of the natural flow of the St. Mary River, at the international boundary of the Milk River at the Eastern Crossing, and of the Eastern tributaries of the Milk River at the international boundary by measurement in each case:

(1) At the gauging station at the international boundary;

(2) At all places where any of the waters which would naturally flow across the international boundary at that particular point are diverted in either country prior to such crossing;

(3) At all places where any of the waters which would naturally flow across the international boundary at that particular point are stored, or the natural flow thereof increased or decreased prior to such crossing;

(b) To fix the amount of water to which each country is entitled in each case by applying the directions contained in paragraphs I, II, and III hereof to the total amount of the natural flow so ascertained in each case.

(c) To communicate the amount so fixed to all parties interested so that the apportionment of the said waters may be fully carried out by both countries in accordance with the said directions.

VI

Each country may receive its share of the said waters as so fixed at such point or points as it may desire. A gauging station shall be established and maintained by the Reclamation or Irrigation Officers of the country in which any diversion, storage, increase or decrease of the natural flow shall be made at every point where such diversion, storage, increase or decrease takes place.

VII

International gauging stations shall be maintained at the following points:—

St. Mary River near international boundary; the North Branch of Milk River near international boundary; the South Branch of Milk River near international boundary; Milk River at Eastern Crossing; Lodge Creek, Battle Creek, and Frenchman River, near international boundary; and gauging stations shall be established and maintained at such other points as the Commission may from time to time approve.

VIII

The said Reclamation and Irrigation Officers are hereby further authorized and directed:

(a) To make such additional measurements and to take such further and other steps as may be necessary or advisable in order to insure the apportionment of the said waters in accordance with the directions herein set forth.

(b) To operate the irrigation works of either country in such a manner as to facilitate the use by the other country of its share of the said waters and subject hereto to secure to the two countries the greatest beneficial use thereof.

(c) To report to the Commission the measurements made at all international and other gauging stations established pursuant to this order.

IX

In the event of any disagreement in respect to any matter or thing to be done under this Order the said Reclamation and Irrigation Officers shall report to the Commission, setting forth fully the points of difference and the facts relating thereto.

X

The said Order of the Commission dated the 6th day of April, 1921, is hereby withdrawn, except with respect to the report to be furnished to the Commission thereunder.

Dated at Ottawa, Canada, this 4th day of October, 1921.

(Signed) C. A. Magrath
O. Gardner
H. A. Powell
C. D. Clark
W. H. Hearst
Mark A. Smith

In the matter of the measurement and apportionment of the waters of the St. Mary and Milk Rivers and their tributaries in the State of Montana and the Provinces of Alberta and Saskatchewan, under the terms of Article VI of the Treaty of January 11, 1909

The Commission finds, as the result of a very thorough investigation of the possibilities of irrigation development in those portions of the State of Montana and the Provinces of Alberta and Saskatchewan capable of irrigation by the waters of the St. Mary and Milk Rivers and their tributaries, that the quantities of land in this international region susceptible of development far exceed the capacity of the rivers in question even under the most exhaustive system of conservation. It is therefore of the utmost importance, not only because of the practical benefits to accrue to the people of this Western country, but still more because the St. Mary and Milk Rivers problem is one that might easily become a source of serious irritation and misunderstanding to the people of the two countries, that every effort should be made to obtain the maximum efficiency in irrigation from these waters.

In the first Annual Report of the United States Reclamation Service, 1902, a project was outlined for the storage of 250,000 acre feet of water, by means of a dam across the outlet of the St. Mary lakes.

And further the United States Reclamation Service has already constructed a reservoir at Sherbourne Lake, and the Commission is informed that said service has in contemplation the construction of what is known as the Chain-of-Lakes reservoir in the valley of the Milk River after that stream leaves Canada; and that the Reclamation Service of Canada has in contemplation the construction of what is called the Verdigris Coulee reservoir on the northern side of the Milk River.

The Comission is strongly of the opinion that the construction of said St. Mary Lakes, Chain-of-Lakes and Verdigris Coulee reservoirs, and the operation of all reservoirs under its direction, will make it possible to conserve practically the entire winter flow and flood waters of the two streams and insure the greatest beneficial use of the same to both countries. Because of the international interests involved and as a means of furthering those relations of neighbourliness and good fellowship which it is convinced the people of both countries have earnestly at heart, the Comission believes that the cost of construction of the works at the outlet of St. Mary Lakes should not be charged against any particular project but should be borne jointly by the Governments of the United States and Canada; the legal title of said reservoir to be vested in the United States.

It is therefore ordered that the following recommendations be respectfully submitted to the Governments of the United States and Canada:

That the Governments of the United States and Canada enter into an agreement for the construction of a reservoir at St. Mary Lakes in Montana.

That the Reclamation Service of the United States proceed with the construction of the proposed Chain-of-Lakes reservoir in Montana, and the Canadian Reclamation Service with the proposed Verdigris Coulee reservoir in Alberta.

That all reservoirs herein mentioned be constructed, controlled and operated in the summer, for the purpose and subject to the conditions above set forth.

Dated at Ottawa, Canada, this 6th day of October, 1921.

(Signed) C. A. Magrath
O. Gardner
Henry A. Powell
C. D. Gardner
W. H. Hearst
Mark A. Smith.

Canadian Engineering Standards Association

Sub-Committees on Steel Railway Bridges and Steel Highway Bridges

A Joint Meeting of the above Sub-Committees was held in Ottawa on September 12th and adjourned to Montreal on Septembr 26th, under the Chairmanship of P. B. Motley, M.E.I.C. The Draft Specification for Steel Highway Bridges was considered in relation to the provisions of the C. E. S. A. Standard Specification for Steel Railway Bridges, with a view of ensuring the agreement of these Specifications on all essential points, and considerable progress was made in harmonizing their requirements.

Among the important points under discussion were the requirements for timber and paint for bridge work, for both of which draft specifications were approved.

A panel of four members was appointed to consider the draft Railway Bridge Specification forwarded by W. A. Duff, M.E.I.C., of the Canadian National Railways, with instructions to report at the next meeting and make recommendations as to the best way of harmonizing its provisions with those of the C. E. S. A. Railway Bridge Specification.

It was arranged to hold the next meeting of the Sub-Committees in Toronto during the last week of October.

Meeting of Main Committee

The Sixth Meeting of the Main Committee of the above Association was held on Monday, October 17th, at the Association's office in Ottawa, H. H. Vaughan, M.E.I.C., in the chair.

After the transaction of formal business regarding appointments, resignations, and changes in membership of the various sectional and sub-committees, the Secretary's report on the work accomplished since the last meeting was presented and approved.

During this period, meetings of working committees have been held as follows:

Sub-Committee on Cement	June 27, 1921
Sub-Committee on Watthour Meters	Aug. 25, 1921
Sub-Committee on Steel Railway Bridges	Sept. 12th and 26th.
Sub-Committee on Steel Highway Bridges	Sept. 12th and 26th.
Panel on Bridges	Oct. 3rd-6th.

The list of publications of the Association now stands as under:

No. 1—1920 Standard Specification for Steel Railway Bridges.
No. 1A—1920 Do. (Separate Reprint of Material Specifications.)
No. 2—1920 Standard Requirements for Distribution Type Transformers.
No. 3—1921 Standard Specifications for Galvanized Telegraph and Telephone Wire.

The Specification for Wire Rope, as approved by the Main Committee in August, is now in the press and will shortly be issued.

The Specification for Steel Railway Bridges (No. 1-1920) being now out of print, active steps are being taken in preparing a new edition, in which a number of important alterations and improvements are being incorporated, with a view of bringing it into agreement with the most recent practice of the large railway administrations.

The first draft of the Highway Bridge Specification has been amended and is now being held, in order that it may be brought into general conformity with the provisions of the revised Railway Bridge Specification.

The work of the Sub-Committee on Incandescant Lamps, Wood Poles for Transmission Lines, and Watthour Meters is actively proceeding.

The Committee approved the list of members for the Sub-Committee on Concrete and Reinforced Concrete and it is expected that this Committee will commence its work at an early date with a view of preparing general specifications for these materials, based on the existing specifications of *The Engineering Institute of Canada.*

The Specification for Portland Cement is being finally revised by the Sectional Committee, and will be submitted to the Main Committee for approval and publication at an early date.

The Committee next considered a number of suggestions as to future activities, and a communication forwarded from the Brantford Chamber of Commerce to the Department of Trade and Commerce, and passed to the C.E.S.A., was laid before the Committee, in which attention was drawn to the desirability of Dominion-wide standardization of fire hose thread and couplings. The Committee felt that this question is of considerable importance in Canada and the Secretary was directed to communicate with various authorities concerned including the fire underwriters and the fire marshals to obtain their opinions as to the best course to be taken.

The Secretary reported that discussions were proceeding as to the best method of co-operation with the American Engineering Standards Committee in connection with their work on the Safety Code for Elevators, the Safety Code for Logging and Sawmill Machinery, Tolerances on Shafting, and Standardization of Gearing; in the latter case the Association having been requested to nominate a representative to attend the meetings of the A.E.S.C. Sectional Committee.

Reports were presented regarding various points which were considered at the Conference of Secretaries held in London in May, and the Committee approved the scheme for the systematic interchange of information between the various national standardizing bodies as to the condition and progress of their work.

The scheme outlined for the interchange of publications of the various national standardizing committees was approved as far as the C.E.S.A. is concerned.

Suggestions from the Dutch and Swedish standardizing committees were considered, dealing respectively with the round numbers to be adopted in official publications in giving the metric equivalent of inch sizes, and in regard to international action looking to agreement on the width across flats of nuts and bolt heads. Further enquiry and correspondence was directed in both these cases.

Discussion followed on points regarding organization and policy. A scheme for the periodical revision of the lists of members of working committees, and arrangement for the periodical revision of specifications were considered and approved.

The Secretary reported the receipt of certain standard specifications issued by the Australian Institute of Science and Industry, and the interchange of publications with this Institute was authorized.

Correspondence, with offers of co-operation and assistance, was read from the Canadian Electrical Association and from the Electrical Co-Operative Association of the Province of Quebec, and the Committee expressed its appreciation of the kindness of these organizations.

The auditor's statement for the six months ending Sept. 30th was presented and was approved as being satisfactory.

St. Lawrence Navigation and Power Investigation

A public session of the International Joint Commission will be held in the offices of the Commission at Ottawa on Monday, November 14th, at ten o'clock a.m. at which all parties who may have submitted comments or criticisms in connection with the Report of the Engineering Board, or alternative plans, will have an opportunity of submitting their views.

CORRESPONDENCE

Another Concrete Failure

Editor, *Journal*:— September 30th, 1921.

Dear Sir:

We are continually hearing of failures in concrete structures due to the design being fundamentally inadequate in strength.

In the issue of the Engineering News-Record for September 15th, there was a long article entitled "Form Settlement Causes Concrete Building Collapse." This was the Masonic Temple in Salina, Kansas, and the report states that not only the proposed completed building but the temporary falsework was deficient and fundamentally inadequate in strength. This is the most recent example of incompetent architects successfully blinding a gullible committee as to their ability and knowledge of the theory of design and thereby securing the contract to design and erect an important structure which has failed to stand up.

Other examples may be sited as follows:—In the Engineering News-Record, December 27th, 1906, there is an account of a reinforced concrete girder bridge which collapsed under a traction engine after it was in service for sometime. In the Engineering News-Record, April 23rd, 1908, there is an account of a reinforced concrete girder bridge which collapsed in the night with no load upon it, two years after it was built. Both of these bridges were said to have been failures due to original weakness in design, and both of these bridges had short shear members.

In the Engineering News-Record of August 18th, there is a report of a collapse of a reinforced concrete ceiling in the Marlborough-Blenheim Hotel at Atlantic City. The cause of this failure was said to be the rusting of steel. However, Edward Godfrey has stated that the steel in this structure was stressed up to 100,000 lbs. per square inch, and that the concrete was being asked to take tension, which, as we all know, is contrary to established practice.

Herewith is another glaring example of what we may call, for politeness sake, "Poor Design." On the drawing attached herewith is shown one of the typical roof beams which failed. This beam was built to support the roof, and the lines of failure are as shown on each side of the beam. These beams were spaced 8 feet 9 inches centre to centre. The length of beam was 32 feet 0 inches. The height of beam varies from 2 feet to 4 feet high by 8 inches wide. The steel allowed was 2-1-⅛ inch longitudinal straight bars placed at a distance of 5 inches up from the bottom of beam, this to carry a total loading of 35,000 lbs. I have shown in a table under the sketch a shear diagram, an area diagram, and also a unit shear diagram. From stresses due to moment we find at once that the steel is being asked to take 21,400 lbs. per square inch with the concrete at 975 lbs. per square inch, which is excessive, and good engineering practice would have called for stirrups or other web reinforcing where the shear exceeds 32 lbs. as shown in the sketch.

Is it therefore to be wondered, in viewing the above from the designers' point of view, why these beams did not fail long ago? What actually occurred is that the failure started along the cracks on the ends of the beam, as shown, and the actual failure may be explained by the following facts:—

1st.—The beam was poured monolithically with the concrete side walls, and there was therefore a tendency for cantilever action, and further, the tops of the beams at the ends were in tension with a negative bending moment, as is the case in continuous beams.

2nd.—Further–The steel was placed at a distance of 5 inches above the bottom of the beam, which is not good engineering practice. Reference is made to the progress report of the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete, as submitted to constituent organizations on June 4th, 1921.

Paragraph 67 reads in part as follows:—

"Metal reinforcement in fire-resistive construction shall be protected by not less than 1 inch of concrete, in slabs and walls, and not less than 2 inches in beams, girders, and columns, provided aggregate showing an expansion not greater than that of limestone or trap rock is used."

It is clearly evident that since the bottom side of the beam is in tension, therefore the steel should be as near the bottom as possible in order to take the tension, as good engineering practice does not allow any tension to be taken up by concrete, and the only reason why we embed the steel in the concrete for 2 inches is for fire protective purposes.

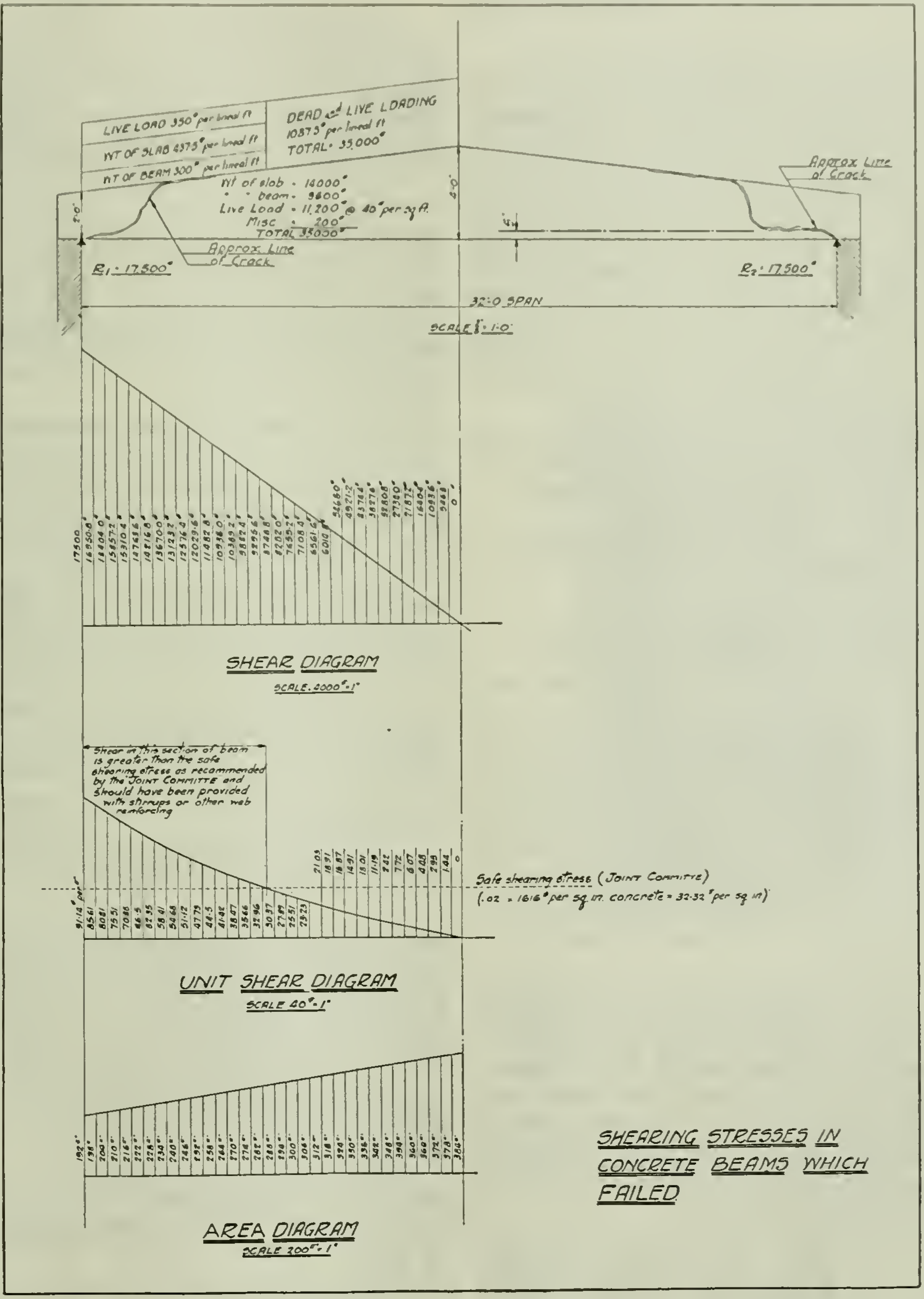
3rd.—It is further clearly evident that in the present case, 5 inches from bottom of beam to steel is entirely too much, and we have therefore the concrete in tension all along the bottom of these roof beams.

4th.—Finally–The high shear and diagonal tension stresses which set up in this beam near the ends were not properly taken care of by shear reinforcement and we have therefore failure in the beams along the lines of structural weakness as the natural and logical result.

Yours very truly,

HERBERT CANTWELL, A.M.E.I.C.

Espanola, Ont.



SHEARING STRESSES IN CONCRETE BEAMS WHICH FAILED

From a Member in South America

Sept. 3rd, 1921.

Editor, *Journal,*
Dear Sir:—

I have been kept more than busy getting into my new work, as in addition to heavy construction work in a new country we have been launching a new company, having formed a combination with a hydro-electric company which opens a very wide field for development.

There is a world of interest in this part of South America, and I am inclined to believe that in the district about 600 to 1000 miles south of Santiago, there will some day be a great opportunity for Canadian logging and lumber enterprise. My company is developing water power in the Andes in mountains rising 22,000 feet and the industrial power field is as yet untouched. The Chilian Government are just placing contracts for the electrification of the railway between Santiago and Valparaiso for which we shall supply the power.

I hope *The Institute* is growing in members and stability and trust that in ten or twenty years time we may find that it was laid on sound foundations.

Yours very truly,
R. F. Hayward, M.E.I.C.

Chilian Electric Tramway & Light Co., Ltd.,
Santiago (Chile).

Recent Town Planning Convention

Editor, *Journal:*— October 3rd, 1921.
Dear Sir:—

Permit me to thank you most cordially for your very kind letter of 27th of September in which you communicate a resolution of your Council putting *The Engineering Institute* rooms at the disposal of those attending the recent conference under the auspices of the Town Planning Institute of Canada and the Montreal City Improvement League.

We also thank you for your kind accommodation in allowing us the use of your projection lantern, and greatly appreciate the special "whip" issued to members of your Montreal Branch.

And we would especially like to put on record our recognition of the extremely valuable help given us by a number of your most prominent members, who are not members of our institution, in presiding over, contributing papers to, and participating generally at, our sessions.

We are conscious that without such aid our conference would not have been nearly the success that it was, and we hope that its effects will be lasting benefit to the City of Montreal and to the cause of Town Planning, in which engineering knowledge and skill is such a vitally important and fundamental factor.

Yours very truly,
Wm. H. Atherton, Secretary,
of Town Planning Conference and
Secretary of the City Improvement League of Montreal.

51 Common Street, Montreal,

The American Association for the Advancement of Science

Through its meetings and through its publications, the American Association for the Advancement of Science promotes intercourse and co-operation and the feeling of fellowship among scientists and those interested in the advance of science and education. North America and South America are its special geographic fields, but members may be citizens of any country.

The Association has become a great affiliation of American scientific societies. A large number of the associated societies regularly meet with it and the facilities of the Association are always at the disposal of these societies, for the arrangement of meetings, the preparation of programme, etc.

The seventy-fourth meeting of the Association will be held at Toronto, Canada, December 27 to 31, 1921 by invitation of the University of Toronto and of the Royal Canadian Institute.

The programme will excel especially in opportunities for personal and social contact among those in attendance, the scientific workers of the two great English speaking nations of North America will here have opportunities for becoming even better acquainted than they now are and for strengthening the bonds of mutual understanding and of personal and national friendship.

J. B. Tyrrell A.M.E.I.C., mining engineer, 14 Walmer Road, Toronto is the Vice-President for the Engineering Section while Professors R. W. Angus, M.E.I.C., and P. Gillespie, M.E.I.C., of the University of Toronto, are local section representatives for the Toronto meeting.

Mr. Tyrrell is already able to announce a strong programme for the engineering section meetings. Sir Adam Beck and others of the Ontario Hydro-Electric Commission, will deliver addresses. There is also expected a lecture on Hydro-Electric development in the Province of Quebec.

E. L. Cousins, A.M.E.I.C., of the Toronto Harbour Commission is to give an illustrated lecture on Toronto Harbour Improvements.

One session at least will be devoted to mining develop ment in Canada. There can be expected excellent lectures and moving picture films of the largest mines and mining plants in the country. At this session there will be an address by one of the officials of the Imperial Oil Company who will explain the work of the company in their search for oil throughout Western Canada.

Another session will be devoted to papers and addresses by some American engineers, and not the least interesting feature of the session will be a dinner to the engineers.

It is hoped this year to make the engineering section meetings of special prominence. It is a section that the executive of the American Association for the advancement of science wish to have more fully developed than in the past.

All engineers are cordially invited to be present at the Toronto meeting; to the Eastern members of the E.I.C., who will be unable to take a trip to Winnipeg for the annual meeting this winter a special invitation is extended.

Members' Exchange

Back Numbers of Journal Required

Members having copies of the following numbers of *The Journal* which can be spared will oblige the Secretary by mailing to headquarters:

1919: January, February, March, May, October.
1920: April, May, June, July, December.
1921: January, March, April.

For Sale

5″ transit theodolite make, T. Cook & Sons, year made 1896, 3 cross hairs, reading to 20″ with complete vertical circle and compass attached to telescope stand and case complete. Price $125.00. Box No. 18-A.

OBITUARIES

Francis Ferguson Busteed, M.E.I.C.

In the death of Mr. Francis Ferguson Busteed, M.E.I.C., which occurred Sunday, 2nd October at Vancouver, B. C., the Canadian Pacific Railway loses another of its retired officials who made history for the company in Western Canada.

Mr. Busteed was a former general superintendent of the Pacific division of the C. P. R., a position to which he was called in 1907 and occupied until his transfer as general superintendent to the Manitoba division in 1912. He was also equally well known as an official in the engineering department, having been in charge of many important engineering undertakings on the C. P. R., including the double tracking of the road from Calgary to the Coast, and the construction of the spiral tunnel through the Rockies at Field.

Mr. Busteed was born at Bonaventure, Que., October 10, 1858. He was educated in the Montreal schools and later graduated from McGill University. He was married in 1885 to Miss Clara L. Ferguson. He entered the Canadian Pacific service in 1879, in 1890 he left it to join the Canadian and Great Falls Railway, and was subsequently in the office of the city engineer at Bristol, Va. He joined the Canadian Pacific in 1894, being successively assistant engineer, resident engineer, engineer of maintenance of way and structures, and division engineer and superintendent. In June 1904, he was made assistant chief engineer, and in 1907 general superintendent at Vancouver. In 1912 Mr. Busteed was transferred to Winnipeg as general superintendent of the Manitoba division, but almost immediately re-entered the engineering department of the railway, having charge of much important work following that time until his retirement in 1918. He did little active work since that time.

Mr. Busteed had apparently been in the best of health, and only recently had moved from quarters, which he had occupied at Glencoe Lodge, to Fifth avenue and Tolmie street. He was stricken with heart failure and death occurred in a few hours. Mr. Busteed was elected a member of *The Institute* on 11th May 1905.

Sir John Kennedy, K.B., Hon.M.E.I.C.

The passing of Sir John Kennedy at his home, 100 Crescent Street, Montreal, on Tuesday, October 25th., after an illness of a few months, marks the removal from the engineering profession of one who occupied a warm place in the affections of his fellow engineers, and who stood at the pinnacle of his profession in this country. Ripe in years, rich in experience and endowed with those fine sterling qualities that made him a credit to the profession, his judgment respected, and his presence welcomed, his death removes one of those stalwarts of the profession, few of whom remain, who organized the Canadian Society of Civil Engineers, and was throughout his lifetime was a living monument to the service which engineers may render humanity.

Sir JOHN KENNEDY, K.B., Hon.M.E.I.C.

The late Sir John Kennedy was born at Spencerville, Ontario, in 1838, and was educated at the Ottawa Grammar School and McGill University. Early in his career he gave evidence of unusual ability and while still a young man had risen to the position of chief engineer of the Great Western Railway System, then the most important in Canada. In 1875, when the deepening of the St. Lawrence River ship channel to twenty-four feet was determined upon and the necessary legislation obtained, the management of the work, as well as that connected with the harbour enlargement, was put into the hands of John Kennedy as chief engineer, who resigned his position as chief engineer of the Great Western Railway System to enter upon his new duties. Mr. Kennedy, as he then was, in addition to having a large and varied experience in civil and mechanical engineering, already had a knowledge of the ship channel and harbour works, having been an assistant to the late Thos. C. Keefer, C.M.G., while engineer of those works, and to the latter's successor, the late Robert Forsyth. The method of deepening advised by Mr. Kennedy, as being the most advantageous to the shipping trade of the harbour, was adopted for that and all subsequent deepenings of the ship channel carried out by the Harbour Commissioners. On the revival of trade in 1888, the Commissioners instructed Mr. Kennedy to prepare a scheme of harbour enlargement, which he did, and of which the main features were a guard pier enclosing between the embankment and the shore a great basin of one and a half miles in length, protecting from the ice-shoves in Winter and from the swift currents in Summer, and having a series of piers extending from the shore wharves in the space between the entrance of the Lachine Canal and the Victoria Pier; as well as the extension of the harbour railway tracks to all the wharves. The flooding of the city by Winter floods of unprecedented heights in 1886 and 1887, led to the construction of a temporary dyke of earth and timber along the river side of Commissioner Street and Common Street, which had been advised by Mr. Kennedy and other members of the Royal Commission appointed to study the problem. By the substitution of a permanent masonry wall for the temporary dyke, the city has ever since been successfully protected from the flooding caused by the ice jams in Winter. The work of enlarging the harbour was commenced in 1890, under the supervision of Mr. Kennedy, and by the end of 1906 the Port of Montreal, as it is to-day, was clearly outlined. In 1899, Mr. Kennedy's eyes became affected by an incurable ailment and by the beginning of 1907 his sight was so far gone that he resigned his position as chief engineer, upon which the Commissioners appointed him their consulting engineer, a post which he held to his death.

In addition to his inestimable services to the Port of Montreal, Sir John left many traces of his great ability and his readiness to exert himself for the public good. He was called to serve on many important commissions, whose findings have done much for the progress of Canada. In 1886, he was appointed on a Royal Commission to enquire into the leasing of water power on the Lachine Canal; in the same year on a similar body to solve the problem of spring floods at Montreal; in 1888 on a Royal Commission to report on the advisability of completing the Trent Valley Canal. He was also on the Commission which in 1907 reported against the hydro radial system in Ontario, and one of the rate-paying engineers who persuaded the civic administration some years ago to abandon the plans being followed for the new aqueduct system. He was also frequently called to arbitrate or advise on important disputes or problems of engineering.

In 1892 the late Sir John Kennedy was made President of the Canadian Society of Civil Engineers, of which he was one of the nineteen founders in 1887, being the sixth President. From the time of its establishment he was one of the most interested in its welfare and was always ready to promote the best interests of the profession. In 1907 he was elected an Honorary Member in *The Institute,* as a tribute to the high position he occupied in the engineering profession in this country. He was also a member of the Institution of Civil Engineers of Great Britain, and since 1915 Chairman of the advisory committee of the Council for Canada. He was a member of the American Society of Civil Engineers since 1875, and a director for a number of years.

Although for the last fourteen years of his life Sir John was deprived of his sight, his mind remained keen and alert, and his interest in all matters calculated to benefit the profession was unabated. He took an active part in church and benevolent organizations, being one of the founders of the School for the Blind, a director of the Y.M.C.A., and for many years a worker in the Sunday School of the Olivet Baptist Church.

The service which he rendered to Canada were recognized by knighthood in 1916. In March 1917, the degree of LL.D. was conferred on him by McGill,and in May of this year that of D.C.L. was conferred by McMaster University, Toronto.

Sir John is survived by two daughters, Lady Ames, wife of Sir Herbert Ames, and Mrs. H. C. Kennedy, of Montreal; four brothers, William, of Montreal, Matthew, R.P., and George Kennedy of Owen Sound; and two nephews, H. C. Kennedy, A.M.E.I.C., and W. Allan Kennedy, of Montreal.

The President and Council of *The Institute* expressed the feeling of the profession with a wreath of flowers bearing a card on which was inscribed "The President and Council of *The Engineering Institute of Canada* mourn the loss of a beloved confrère, the Dean of the engineering profession in Canada".

The funeral which took place from Olivet Baptist Church on Thursday, October 27th, was attended by a large body representative of the leading educational, commercial and social interests of the community.

Major Stuart Thorne, M.C., A.M.E.I.C.

Major Stuart Mills Thorne, M. C., A.M.E.I.C., Croix de Guerre, died Oct, 3rd, 1921 at the home of his uncle, A. E. Osler, 36 Summerhill Gardens, after five months illness of a heart malady caused by exposure while on active service. Major Thorne, who was 41 years of age, was born in Lloydtown, Ont. He was a son of the late Horace Thorne, Toronto, barrister, and grandson of the late Canon H. DB. Osler. He graduated with the B. A. Sc., degree at the University of Toronto in 1900 and was engaged in mining operations in Cobalt when the war broke out. In 1915 he went overseas with No. 7 tunnelling Company and did much valuable work in 18 months' important operations at Messines Ridge. Later he joined the Fifth Engineers. He was discharged in 1919 and later had charge of operations at the Golconda Mines. Latterly, however, he was an assistant engineer on the Chippawa-Queenston Power Project of the Hydro-Electric Power Commission of Ontario. He was elected Student Member of *The Engineering Institute* in 1904 and Associate Member in 1909. He was an Anglican, a Free Mason and a member of the Toronto Engineers' Club. Surviving him are a brother, Harold S. Thorne; a sister Miss Elsie M. Thorne and his uncle A. E. Osler.

Major John Mason, D.S.O., M.C., A.M.E.I.C.

It is with sincere regret that we have to record the death of Major John Mason, D.S.O.,M.C., late of the Royal Engineers, who died at the Jubilee Hospital, Victoria B.C. on September the 24th. after a painful illness of some weeks' duration.

The deceased officer was a regular attendant at meetings of the Victoria Branch. Previous to the war he had practised his profession throughout British Columbia, and was well known for his ability and integrity, it was while engaged upon railway construction that he earned the cognomen of 'trusty John.'

During the war he served with the Royal Engineers with distinction, in France from August 1915 to February 1919 and in Russia from the latter date until May 1920, returning to British Columbia only as recently as January of the present year. He was elected Associate Member of *The Engineering Institute* in July, 1915.

The funeral took place on September the 29th. at Ross Bay Cemetery, Victoria, and was with full military honours. The service was conducted by Col. Rev. G. H. Andrews, and was attended by a large number of friends including several members of the Union Club, of which the deceased gentleman was a member; the Victoria Branch of *The Engineering Institute of Canada*, and the Department of Soldiers Civil Re-establishment, were also represented.

A draped gun-carriage was used to convey the casket to the cemetery, and a firing party of the P.P.C.L.I. fired the salute over the grave.

PERSONALS

R. C. McClelland A.M.E.I.C., was with the Standard Paving Limited, Ottawa, for the summer months.

Geo. Hemmerick, A.M.E.I.C., has registered for post-graduate work at Queen's University, Kingston, Ont.

H. M. Dibblee A.M.E.I.C., is at present with the In and J. B. Railway, Residency No. 3, Kipawa, Ont.

W. F. Oldham, A.M.E.I.C., has been appointed municipal engineer, Swan River, Man.

T. C. Jepson, A.M.E.I.C., has recently returned to Canada, and is at present resident in Toronto, Ont.

Capt. G. H. Cagnat, M.E.I.C., has been transferred by the Dominion Department of Public Works to Winnipeg, Man.

A. S. Weekes, A.M.E.I.C., has been appointed chief land surveyor of the Western Lines, Canadian National Railways, with headquarters at Winnipeg., Man.

Stanely Shupe, A.M.E.I.C., formerly town engineer, Oshawa, Ont., has been appointed city engineer, Kitchener, Ont.

W. W. Crouch, Jr., Jr.E.I.C., with the firm of Black and Veatch, consulting engineers, has been transferred from Kansas City to Mexico, Mo.

U. R. Moore Jr.E.I.C., has recently joined the staff of the Hydro-Electric Power Comission of Ontario, on the Chippawa-Queenston Power Development.

Chas. Pearson, S.E.I.C., recently resident in Hamilton, Ont., has left for La Romana, Santo Domingo, to take up counstruction work in that country.

C. V. von Abo, S.E.I.C., who was formerly a student in engineering at McGill Unversity is now at Cornell University, Ithaca, N. Y.

Harold W. Harkness A.M.E.I.C., associate professor in physics, Shantung University, China, is at present home on a visit to his parents at Wroxeter, Ont.

J. Matheson Fraser, Jr.E.I.C., has accepted an appointment with the Department of Mechanical Engineering, University of Saskatchewan, Saskatoon,.

Col. F. F. Longley D. S. M., C.B.E., M.E.I.C., acting general medical director, The League of Red Cross Societies, is now in Melbourne, Australia on work in connection with the Red Cross.

John Callaghan, M.E.I.C., has been appointed deputy manager of railways, Alberta, Mr. Callaghan will also act as manager of the Alberta Government railway lines.

G. C. Street, M.E.I.C., until recently in Peru has returned to Canada to take the position of manager for the Winnipeg Double Wall Construction Company, Winnipeg, Man.

W. S. Lockhart, A.M.E.I.C., late of the Riordon Company, Ltd., has accepted a position with the West India Electric Company, Limited, at Kingston, Jamaica, as assistant chief engineer.

E. S. Mattice, M,E.I.C., for many years on the engineering staff of the Dominion Bridge Co. Limited, and latterly general contracting engineer for the company, has been appointed managing director of the Phoenix Bridge and Iron Works Limited, Montreal.

D. K. C. Strathearn., Jr. E.I.C., has been appointed a demonstrator in hydraulics, Unversity of Toronto for the 1921-22 session. Mr. Strathearn until recently was employed with the Hydro-Electric Power Commission of Ontario at Morrisburg, Ont.

B. B. Kelliher, M.E.I.C., formerly chief engineer Grand Trunk Pacific Railway and of recent years resident in the Western United States has been appointed assistant to the president, Denver and Rio Grande Western Railroad, Denver, Colo.

H. L. Hayne, A.M.E.I.C., formerly assistant engineer on construction of the Esquimalt and Nanaimo Railway extension is now assistant district engineer with the British Columbia Department of Public Works, Fernie, B.C.

Colonel E. G. M. Cape, M.E.I.C., has donated a memorial cenotaph to Montreal which has been prepared after the design of Kenneth Rae, and accepted by the National Poppy Day Committee. The cenotaph will be unveiled on Dominion Square, Montreal, by Lord Byng of Vimy, Governor-General of Canada.

Kenneth H. Smith, A. M. E. I. C., formerly of McGill University, and now resident at Wolverhampton, England, spent the past two months in Canada visiting friends. Mr. Smith is engaged in helping to solve the housing problem in England, and at present has in course of erection a number of cottages to complete a village site laid out on modern lines.

O. S. Finnie, M.E.I.C., who has been acting governor of the Peace River oil district during the past summer has returned to Ottawa for the winter. Mr. Finnie has been in absolute control of the new oil territory and the fact that an engineer was appointed to this important position has given great satisfaction to the profession. Mr. Finnie expects to return to the NorthWest next summer.

T. P. Strickland, M.E.I.C., has been promoted by the New South Wales Government Railways and Tramways to the position of chief engineer of the Melbourne and Metropolitan Tramway Board. An extensive programme of electrification has just been completed by the Government Railways in Melbourne and Mr. Strickland is to be congratulated on his association as chief engineer with such a progressive body as that which controls the railways and tramways of New South Wales.

Major J. K. Wyman, A.M.E.I.C., who is now serving in the Indian Army, Military Works Dept., Lahore District, has seen continuous service with the exception of a few months in 1919 since November 1915. Following appointment as second lieutenant he sailed for Egypt in July 1916 and served in that field until demobilization in July 1919 by which time he has risen to the rank of major and had been mentioned in despatches. Major Wyman was repatriated to Canada but joined the forces again in October 1919 with the rank of major and has remained in military service since that date.

COL. F. M. GAUDET, M.E.I.C.,
Technical Executive Officer, The Honorary Council for Scientific and Industrial Research.

R. de L. FRENCH, M.E.I.C.

R. de L. French, M.E.I.C., has been appointed professor of highway and municipal engineering at McGill University. Mr. French's career as an engineer of note is well known to the majority of *Institute* members and his work of recent years with the Lignite Utilization Board is particularly noteworthy. Mr. French is no stranger to McGill, having acted as lecturer in municipal engineering since 1911.

JOHN BROOKE, LORD CONGLETON, Jr.E.I.C.

John Brooke, Lord Congleton, Jr.E.I.C., was born at Clonmal, Tipperary, Ireland in May 1892 and was educated for the British Navy at the Royal Naval College, Osborne. Joining the Navy in 1909, he served as a midshipman with the Atlantic, Mediterranean and China Fleets, and during the early part of the Great War on the West Coast of North and South America. In 1916 he qualified as a gunnery lieutenant and was commissioned with the Destroyer Flotilla of the Grand Fleet with which he served until after the close of hostilities, being placed on the emergency list in March 1919. Following demobilization Lord Congleton entered as a student in Mechanical Engineering at McGill University, graduating with high honours at the close of the 1920-21 session, when in addition to heading the year in Mechanical Engineering he gained the British Association Medal, and the Crosby Steam Gauge and Valve Company's prize for summer essay. His interesting paper on "Naval Gunnery" will be remembered by all members of the Montreal Branch and by all those who read the paper as published in the Journal. He has recently been promoted to Lieutenant Commander on the Emergency List of His Majesty's Navy.

BRANCH NEWS

Victoria Branch

H. M. Bigwood, A.M.E.I.C. Secretary.

The Victoria Branch opened its 1921-22 season with a luncheon on Wednesday October the 5th. As the Council of the Association of Professional Engineers of British Columbia had called an informal meeting to be held in Vancouver on the 14th, and had suggested that members at other places should get together and informally discuss matters relative to the Association, the Branch executive thought that the subject of "Professional Engineering" would be an opportune one and also decided to extend an invitation to all professional engineers, whether members of *The Institute* or not, to be present.

About thirty persons attended and after lunch was partaken of all listened to a short address by E. E. Brydone-Jack M.E.I.C., the general tenor of which was co-operation between all members of the engineering profession. The speaker, lately transferred to Victoria as superintending engineer for Western Canada with the Public Works Department of Canada, spoke very strongly on the question of welfare of engineers generally, and gave it as his opinion that to a very large extent they were themselves responsible for the low standing of the profession in the sight of the public.

He advocated engineers to get more into public life, and gave instances where the calling had materially benefitted and the public better served by having engineers elected to governing bodies.

The Secretary of the Branch, H. M. Bigwood, A.M.E.I.C., called upon by the Chairman, gave some figures of the membership of the *The Institute* and the Professional Engineers in Victoria: Out of a total membership of 730, there were 92 registered professional engineers resident near-by, the Victoria branch had 76 members of *The Institute* of which number 42 were registered under the act, so that 34 E.I.C., members in Victoria were not yet registered.

In all there were 92 plus 34, or 126 engineers within a radius of twenty-five miles of the city, and the speaker claimed that that was sufficient to hold very interesting meetings or social gatherings.

His contention was that any society or association could only be what its members made it, and that therefore *The Institute* and the newly-formed Association depended entirely upon its members to make either as useful as they should be, each in its own special field. He therefore appealed to all present to be interested, to take an active part in discussions and management, not to be content to let anyone else try and then criticize.

The members of the Branch were very disappointed that they had not an opportunity to entertain President Fairbairn on the occasion of his recent visit to the city. By his own request he was allowed to rest quietly during his leisure. He discussed *Institute* matters with the Chairman and Secretary of the Branch, and he advocated more co-operation, just as Mr. Brydone-Jack had done at lunch a few days previously. Engineers had not been the best friends of their professional bretheren in the past, he said; in future all must aim to co-operate to a great extent.

Electric Pumping for Irrigation

On Wednesday evening, October 12th, a fairly well attended meeting of the Branch listened to an address on 'Electric Pumping for Irrigation, Reclamation and Drainage' by Geo. R. Alexander, field engineer of the Byron Jackson Ironworks, San Francisco. A feature of the lecture was the series of 50 lantern slides showing pumps of various sizes and the different methods in which they were used.

Efficiency, economy and convenience were the three reasons advanced by Mr. Alexander for the installation of the type of pumps shown. He traced the development from the old steam plants to the present high efficiency installations of 3,000 to 4,000 H.P., operated by electric power generated at distant mountain points and transmitted at high voltage. Special reference was made to the "Wood" screw pump, and its comparison with the centrifugal type.

Considerable discussion followed, to which the lecturer replied, and a hearty vote of thanks was accorded Mr. Alexander before the meeting adjourned.

E. G. Marriott, M.E.I.C., Chairman of the Branch presided.

Vancouver Branch

J. N. Anderson, A.M.E.I.C., Secretary-Treasurer.

On Saturday, 24th September, the Vancouver Branch visited the Ballantyne Pier which is in course of construction on Burrard Inlet, Vancouver.

By the courtesy of Major G. A. Walkem, M. E. I. C., Branch Chairman, the party of over sixty members and friends were first taken across to North Vancouver on the tug boat "Topaz." At North Vancouver the plant of the Northern Construction Company Ltd., contractors for the work, was inspected and every facility was given to observe the work in progress, which consisted mainly in the pouring of the re-inforced concrete caissons and trusses. Much interest was displayed in the methods of fabricating the re-inforcement and in the steam curing of the caissons.

Returning to Vancouver the party was conducted over the pier works, where caissons were in the various stages of being sunk. The pumping machinery and the various shops were also inspected.

At the conclusion of the visit bountiful refreshments were provided by the Vancouver Harbour Commissioners whose chief engineer is Major W. G. Swan. M. E. I. C. The visit was thoroughly enjoyed and those who were present are looking forward to further visits as the work progresses. A hearty vote of thanks was given to all those responsible for the various courtesies extended.

The consulting engineer for the Ballantyne Pier is A. D. Swan, M.E.I.C., Montreal and his resident engineers are E. H. James, A.M.E.I.C., and T. W. W. Parker, A.M.E.I.C., Wm. Smaill, M.E.I.C., is chief engineer for the contractors.

The President of *The Institute*, J. M. R. Fairbairn, M. E. I. C., in the course of a business visit to Vancouver was the principal guest at the luncheon given to the Executive Committee by the Branch Chairman, Major G. A. Walkem, M.E.I.C., at the University Club on 5th October. After lunch there was an informal talk on Institute affairs and important Branch matters were discussed. The members of the Branch had been looking forward very keenly to an address by Mr. Fairbairn but owing to recent indisposition he was unable to accede to such a request.

Lethbridge Organization Meeting

Col. H. C. Boyden, Chicago, delivered a very able address on October 7th to a group of sixty engineers at the Y. M. C. A. hall, Lethbridge, Alta. His subject was "Recent Development in Concrete." It was illustrated with lantern slides and brought out some points of very great importance which have been established by extensive research work carried on during the past five years at the Lewis Institute, Chicago. Experiments showed that the use of an excess amount of water in mixing concrete may decrease its strength more than 50 per cent. This is a point which has not previously been recognized by engineers and represents a decided advance in their knowledge of the properties of cement. It was also shown that failure to properly protect concrete after it is placed will lower its strength very materially. It should be protected from the weather and kept moist for three weeks after being placed,.

The engineers in attendance at this meeting decided unanimously to establish in Lethbridge a Branch of *The Engineering Institute of Canada* provided authorization was obtained from Council, and appointed a committee to act as an interim executive to arrange the details of organization. The committee consists of S. G. Porter, M.E.I.C., H. B. Muckleston, A.M.E.I.C., G. N. Houston, M.E.I.C., C. D. MacKintosh, A.M.E.I.C., H. W. Meech, A.M.E.I.C., P. M. Sauder, M.E.I.C. and C. M. Arnold, M.E.I.C.,

Calgary Branch

Arthur L. Ford, M.E.I.C., Secretary-Teasurer.
Floyd K. Beach, A.M.E.I.C., Branch News Editor.

On October 4th the Branch listened with much interest to an illustrated address by Lt. Col. Boyden of Chicago on "Some Recent Developments in Concrete." At this meeting the programme committee presented a report that an active programme of meetings has been arranged for the coming winter.

Col. Boyden also addessed a meeting of engineers at Lethbridge during his visit to Alberta. There is now so large a number of corporate members of *The Institute* in Lethbridge that the matter of organization of a Branch at that point was brought up and plans are now under way for its organization.

President Fairbairn met a committee who have charge of plans for organization when he was in Lethbridge on October 17, and on the 18th he was a guest of the Calgary Branch at a luncheon in the Board of Trade. At this luncheon he outlined matters of policy in a very able manner and was the source of much inspiration to the members present. His comments on the subjects of publicity and of professional ethics were very much to the point.

Lethbridge Northern Irrigation District

Work has proceeded very rapidly. 678,000 yards moved in September bring the total excavation up to 2,180,000. Tenders on a supply of timber are being opened as this goes to press, and arrangements are being made for resident farmers to haul the timber during the winter as a measure of relief work. Work on structures is proceeding rapidly. There is a slight shortage of labour, but as harvest is nearly completed, it is anticipated that there will be no shortage in the immediate future.

United Irrigation District

This project has reached the construction stage and a rather novel form of letting work has been adopted. Earth-work tenders have been confined to rate payers in the district. The engineer has set a maximum price of 20¢ per yard for No. 1 material, 50¢ for No. 2, and $1.00 for No. 3. The farmers have formed themselves into groups of two or three, and the successful tenderers have been quoting prices slightly under the maximum. The farmer contractors are being held strictly to account for their work in the same way that a practical contractor would be dealt with. Where ratepayers of the district are contractors they submit to a deduction from each estimate of an amount equal to 40% of their estimate instead of ten per cent in the case of other contractors, and 25% of the amount so deducted will not be paid to the contractor at any time but is to be held by the board of trustees of the district in trust to apply on irrigation rates payable by the contractor on account of principal and interest on the debenture issue. The remaining 15% is held until the completion of the work by the contractor when it is paid in cash. This method of handling the work is more or less of an experiment and it is being watched very carefully to see how it turns out.

Winnipeg Branch

Geo. L. Guy, M.E.I.C., Secretary-Treasurer.

The Executive of the Winnipeg Branch tendered Dr. R. A. Ross, M.E.I.C., and Lesslie R. Thompson, M.E.I.C., members of the Dominion Lignite Board, a luncheon at the St. Charles on the 18th inst.

Dr. Ross outlined the activities of the Board, and enumerated some of the problems that had to be worked out during the time the plant was being put into operating condition. He also very interestingly gave his impressions of the opinion in which engineers generally were held by the public. He was in a position to talk with authority, having been closely in touch with the municipal organization of the city of Montreal for the past few years. While he held this experience very valuable, he was anxious to get back into private practice, which he intends doing in the immediate future.

Border Cities Branch

J. E. Porter, A.M.E.I.C., Secertary-Treasurer.

The Border Cities Branch resumed the regular monthly meetings with a banquet held in the Cadillac Cafe, on Friday, October 14th.

Somewhat higher than the average attendance answered roll call.

Following the regular business of meeting, a resolution was passed to convey to Geo. F. Porter, L.L.D., M.E.I.C., chief engineer of the Canadian Bridge Co., Walkerville, the hearty congratulations of the Branch on the signal honour conferred upon him by McGill University.

A. J. Riddell, M.E.I.C., Chairman, then called upon W. H. Baltzell, M.E.I.C., chief engineer, Canadian Steel Corporation, the speaker of the evening.

Mr. Baltzell gave the attendant members an unusually interesting talk on Steel Plants, tracing the manufacture from iron ore of different steel products, especially steel rails, tool and high speed steels. fence and different sized wires. The speaker also described tempering and galvanizing steel products. He dealt with the development during the war and lastly touched on the relation of steel mills to engineering.

A very hearty vote of thanks was accorded Mr. Baltzell, which was ably conveyed by the Chairman.

Niagara Peninsula Branch

R. P. Johnson, A.M.E.I.C., Secretary-Treasurer.

G. R. Taylor, A.M.E.I.C., Branch News Editor.

No regular meetings of the Branch have been held during the summer months, but the individual members have been very fully occupied during the summer. The two large construction jobs on the peninsula, the Welland Ship Canal and the Queenston-Chippawa Power Development, have received considerable attention this summer from engineers and the general public, over 4,000 having visited the latter work alone.

On October 6th the Toronto Branch in conjunction with a number of the senior engineering students of Toronto University, about 240 in all, paid a visit of inspection to the Queenston-Chippawa Development. They were shown round by members of the Hydro staff and by members of the local Branch who welcomed the opportunity of seeing many old friends. Further news of the trip is given in the Toronto Branch news.

A full and energetic programme has been outlined for the winter months and a very good start was made on October 8th when the Rochester and Buffalo Engineering Societies were the guests of the Branch in a trip over the Queenston-Chippawa Power Development. The visiting societies to the number of about 150 motored from Buffalo by the Canadian boulevard, inspecting the intake and river section and bridges at Chippawa on the way down. About thirty members of the local Branch met the visitors at the H. E. P. C. offices and there the party boarded a train, kindly supplied by the Commission, and proceeded over the construction railway for an inspection of the canal, afterwards motoring to Queenston where another Hydro train took them to the powerhouse.

As this work has been described quite fully in previous issues of *The Journal*, it is not necessary here to give any full description but a few remarks in regard to the progress noted may not be out of place.

Both the river section and the first mile of the canal, which is in earth, have a sufficient water area for present requirements. Of the eight miles of concrete lined canal, less than a mile and a half requires completion. One of the large penstocks is already in place and another well under way, while in the powerhouse, one of the large generating units is practically complete, and another is well under way.

After inspecting the powerhouse the party proceeded by motor and street car to Buffalo where the Buffalo Society had arranged for a dinner at the Lafayette Hotel.

The dinner was a great success and was enlivened by music and singing. After dinner, H. G. Acres, M.E.I.C., hydraulic engineer of the Commission, E. T. J. Brandon, A.M.E.I.C., electrical engineer and A. C. D. Blanchard, M.E.I.C., chief field engineer, gave addresses on various aspects of the development, illustrated with lantern slides. Moving pictures of the work were also shown.

Everyone present voted the whole outing an unqualified success and we are hoping during the winter months to extend our acquaintances with our brother engineer's "across the river."

Toronto Branch

F. B. Goedike, M.E.I.C. Secretary-Treasurer.

Niagara Excursion

Activities of the Toronto Branch for the season began on October 6 when an excursion to the Chippawa canal was carried out. Some 200 persons made up the party, about half whom were engineering students from the University of Toronto. Owing to the inability of Geo. T. Clark, M.E.I.C., the Branch Chairman, to be present the past Chairman R. O. Wynne-Roberts, M.E.I.C., took charge. Dean Mitchell and several of the professors of the University were also present with the students. The arrangements made by M. Sauer, M.E.I.C., for the transportation, entertainment and guidance of the party were excellent, despite the fact that the number in attendance was about double that expected.

Opening Meeting

The first meeting of the session took place on October 13th, when the Chairman, Geo. T. Clark, M.E.I.C., gave his inaugural address. Preliminary to the Chairman's address it was decided to refer the matter of appointment of delegates to the convention of the Canadian Deep Waterways and Power Association to the executive, as also the question of co-operation with the American Association for the Advancement of Science in connection with this convention to be held in Toronto in December.

The Chairman in addressing the meeting outlined the possibilities for sucessful work of the Branch during the year. The widening scope of *The Institute* brought about by important economic developments in the country give opportunities for many new activities. These, the Chairman said, had an important bearing on the solution of many difficult human problems.

Mr. Clark outlined the progress of the movement for professional legislation in Ontario and the steps that had been taken in the matter of classification of engineers and the fixing of adequate compensation. He thought that much useful work might well be done in the development of a code of ethics and pointed out that a Branch committee was now framing a tentative code. Much valuable work for the profession might be done, he stated, through an extension of publicity with respect to engineers and their work. He outlined activities of the various committees of the Branch, bespeaking for them the enthusiastic support of the membership.

Much stress was laid by the Chairman on the desirability of engineers entering the public service. He thought that through this course the engineer would do more in obtaining recognition for the profession than in any other way. There was much that might be done by engineers in helping to relieve the unemployment situation. He stated that if an organized effort were made by engineers to promote construction much relief in the unemployment situation could be brought about, particularly through the carrying out of public works. He stated that 70 per cent. of the engineering works of this continent are for public or semi-public uses, and that one-quarter of the natural wealth of the United States is in engineering structures.

In the discussion which followed the Chairman's address R. O. Wynne-Roberts, M.E.I.C. deprecated the fact that the engineer is rather too much of a monk, leaving active, forceful politicians to direct affairs with which the engineer is particularly qualified to deal. G. W. Winkler, M.E.I.C, urged greater publicity on behalf of engineers. C. R. Young, M.E.I.C., pointed out that there was much need for real engineering statesmanship in the country. Wm. Storrie, M.E.I.C., believed that much of the lack of organization of engineers might be attributed to their excessive modesty. G. G. Powell M.E.I.C., expressed the view that engineers are deterred from offering themselves for members of parliament by reason of lack of personal means. He advocated the construction of necessary practicable public works during winter, rather than the handing of relief money to persons out of employment. H. A. Goldman, A.M.E.I.C., thought that insufficient attention was paid to economic problems by engineers. F. B. Goedike, A.M.E.I.C., urged greater attention to the question of public speaking. J. M. Oxley M.E.I.C., moved, seconded by N. D. Wilson, A.M.E.I.C., that the Branch address letter to the city council of Toronto urging that relief to the unemployed be afforded through carrying out necessary public works, rather than by a direct gift of money. W. A. Duff, M.E.I.C., past Chairman of the Moncton branch, gave some interesting facts regarding the E.I.C., in the East.

An interesting innovation was introduced at this meeting in requiring all members present to rise and introduce themselves to the meeting.

Programme of Meetings—October to December 1921

October Thirteenth
Chairman's Inaugural Address, and Social Evening

October Twentieth
Waterproofing Roadway Surfaces
By G. G. Powell, M.E.I.C.

***October Twenty-seventh**
Nickel Production and Uses.
By C. E. Macdonald, A.M.E.I.C.

November Third
Engineering Ethics—Committee's Report.
By T. D. Mylrea, A.M.E.I.C.

November Tenth
Hydro Electric Power Commission Standards.
By W. P. Dobson.

***November Seventeenth**
Pipe Casting by the Centrifugal Process.
By F. W. Hudson.

November Twenty-fourth
Electricity Applied to Railway Signalling.
By C. H. Tillett.

December First
Social Service Committee's Report.
By T. L. Crossley, A.M.E.I.C.

***December Eighth**
Toronto's Park System.
By C. E. Chambers.

December Fifteenth
Street Illumination.
By G. C. Cousins.

*Meetings to be held in Mining Building, University of Toronto.

Peterborough Branch

D. L. McLaren, A.M.E.I.C., Secretary-Treasurer.

The first regular meeting of the Peterborough Branch of *The Engineering Institute of Canada* for the coming season, was held in the Chamber of Commerce Assembly Room, on Thursday, October 13th at 8 p.m.

The executive of the Branch were very fortunate in inducing Norwood M. Lash, chief engineer of the Bell Telephone Co. of Canada to give an address on "The Complex Nature of a Modern Telephone System." The lecture was illustrated with lantern slides and moving pictures. The lantern and motion picture machine are available for all meetings so that the local Branch is quite fortunate in this respect.

Mr. Lash showed how, in his department, engineers plan 7 to 10 years in advance of a city's growth so that telephone facilities especially underground, and cable distribution may keep pace with demand. The remarkable accuracy required of these estimates is shown from the fact that it is necessary to dig up a conduit to increase its capacity.

Mr. Lash next dealt with the wonderful development of the long distance system, citing cases in which open wire must soon give away to wires in cables to care for the heavy demand. The actual productive talking time on long lines was constantly being increased as a measure of economy, and operating efficiencies improved, but each advance along this line called for bigger expenditures in new equipment. The members of the Branch were very interested in the various telephone and morse circuits that can be obtained from two physical pairs of telephone wires.

Mr. Lash closed his address by referring to the need of the adequate rates for service if the public demands for extensions were to be met.

The members of the Peterborough Branch gave a farewell dinner and a presentation on September 22nd to Charles E. Sisson, M.E.I.C., transformer engineer for the Canadian General Electric. Company, and his three associates, A. L. Sutherland, A.M.E.I.C., J. E. Hess, S.E.I.C., and G. L. Jones, S.E.I.C., who are being transferred to the Davenport Works of the C. G. E. Co., the presentation being the membership pin of *The Institute.*

As a member of the Utilities Commission of the City of Peterborough and as a member of the executive of the local Branch of the E.I.C., and various other organizations, Mr. Sisson will be greatly missed.

Kingston Branch

L. T. Rutledge, M.E.I.C., Secretary-Treasurer.

A meeting of the Branch was held on Sept. 30th., 1921, with J. M. Campbell, M.E.I.C. in the chair. At this meeting the retiring Secretary, W. P. Wilgar, M.E.I.C,, gave a progress report of the past year's proceedings and submitted the financial balance sheet which was favorably received insomuch as it showed a substantial increase in the cash balance over the amount at the beginning of the year.

Officers were appointed for the ensuing year as follows:—

Chairman,—— W. P. Wilgar, M.E.I.C.

Vice-Chairman:- L. M. Arkley, M.E.I.C.

Secretary-Treasurer:- L. T. Rutledge, M.E.I.C.

Executive Committee:- Messrs. J. M. Campbell, M.E.I.C., A. McPhail, M.E.I.C., D. J. Emery, Jr.E.I.C.

Programme and Entertainment Committee:- Messrs. R. J. McClelland, A.M.E.I.C., (Convenor) E.W. Skinner, T. McGinniss, A.M.E.I.C., Col. Anderson, D. Ellis.

It is worthy of note that these officers are appointed from members of the staff of Queen's Unversity, The Royal Military College and the engineers residing in Kingston and its neighbourhood.

It was arranged that the second and fourth Tuesday of each month, at eight o'clock in Carruther's Hall., Queen's University be the times and places of holding meetings. A suggested list of papers mostly by local members was submitted for the committee to act upon. A few good papers from outside speakers are anticipated. Papers from student members are to be encouraged and prizes are to be given for student papers.
Article in 8 pt.

Einstein's Relativity Theory

The next regular meeting was held on October 13th. at which L. T. Rutledge, M.E.I.C. gave a popular lecture on Einstein's Theory of Relativity and Gravitation. The discussion proceeded under five headings as follows:

1. The philosophy of relativity with special emphasis on the viewpoint and method of relativity.
2. The concept of time and space and the mechanical principle of relativity.
3. The special or restricted theory of relativity.
4. The general theory of relativity and the theory of gravitation.
5. A few of the applications of relativity, more especially to engineering problems.

The speaker spoke for two hours and held the attention of his audience for every minute throughout. Dean Clarke, of the Faculty of Science of Queen's University commented very favorably on the lecture, intimating that this very difficult theory was never before in his opinion explained so clearly and made so interesting.

The meeting extended its congratulations to Professor McPhail on his receiving the honorary degree of L.L.D. from his Alma Mater, McGill University. Dr, McPhail has distinguished himself as a teacher of engineering and of late as a military engineer, so that *The Institute* and Queen's University have every reason to be proud of him.

At the conclusion of the discussion on "Relativity" the members enjoyed themselves in a "smoker" that had been arranged by the entertainemnt committee, and which was a decided success.

Ottawa Branch

F. C. C. Lynch, Associate E.I.C., Secretary-Treasurer.

The Ottawa Branch of *The Engineering Institute* as their contribution to the activities of fire prevention week had as their speaker at the first luncheon of the season, Ellwood Wilson, M.C., S.F.E., manager of the forestry division of the Laurentide Pulp and Paper Co., of Grand Mere, Que. Mr. Wilson took as his subject "Forests and the Fire Hazard," and in opening said that the basic need in the efforts to overcome the enormous forest fire loss was education of public opinion. The mistaken idea that Canada had inexhaustible forest resources was responsible largely for the lack of interest shown by the public in the destruction of our forest resources by fire, and in the same lack of care in the prevention of fires. Laws for the protection of forests, while undoubtedly good, were greatly minimized by the passive attitude of the public towards their enforcement.

Railways, in Mr. Wilson's opinion, were one of the chief offenders in the matter of forest fires. The results of fire were in evidence from Vancouver to Moncton on both transcontinental lines. Mr. Wilson gave credit to the managers of railways for endeavouring to eliminate this forest fire danger. The advent of the aeroplane had been of great advantage in forest protection. Formerly it had taken probably three or four days for men on the ground to locate a fire, whereas by the aeroplane it could be done sometimes within an hour. Daily reports were secured and a strict watch kept on the forested area.

Dealing with the pulpwood demand, Mr. Wilson stated that what might presently be designated the paper age was creating an enormously increased consumption of the various wood products. The consumption of pulpwood in the United States had risen 1,240 per cent during the past twelve years. In Canada, all timber is as yet practically in control of the public, while in the United States nearly all the timber had been alienated. In the past, unfortunately, it had been the custom to take everything from the forest, returning nothing. More money had to be put back into the forests in the form of better fire protection, and the replanting of denuded areas. It takes from 50 to 100 years to grow merchantable trees, and if the pulp and paper and wood-using industries are to be perpetuated Canada must give greater attention to her forest resources.

Commander C. P. Edwards, M.E.I.C. presided at the luncheon, and seated at the head table, besides the guest, were Lt. Gen. Sir W. G. Gwatkin, C. A. Magrath, M.E.I.C., G. A. Mountain, M.E.I.C., Gordon Gale, M.E.I.C., T. McVeigh, Noulan Cauchon, A.M.E.I.C., G. B. Dodge, M.E.I.C. and others.

Town Planning in Ottawa District.

The city council of Ottawa has unanimously endorsed the Town Planning Commission's efforts towards negotiating with the railways a tentative plan for the reorganization and improvement of the railway entrances and of the terminal facilities of Ottawa. The council also endorsed the commission's efforts to obtain from the Dominion government a reduction in the clearance on the Rideau Canal to 10 feet between the Deep Cut and Hog's Back; also for a general plan for a highway bridge across the canal in the vicinity of Somerset street. With this authorization the Chairman of the Commission Noulan Cauchon, A.M.E.I.C., will shortly submit to the various railways and government departments concerned the tentative plan for reorganization of railway terminals. There is sufficient elasticity in the plan to allow for such revisions and improvements as may come out of the co-operation of the experts representing the various interests.

Theo. Lanctot, A.M.E.I.C., city engineer of Hull, has in hand a programme which calls for the expenditure of over half a million dollars on improvements.

A Rotary Club has been organized in Hull, among the officers is G. Gordon Gale, M.E.I.C., as vice president.

The Ottawa papers recently in commenting the work of the Suburban Roads Commission, which has charge of the main roads leading into the city, paid special tribute to the technical skill of Alan K. Hay, A.M.E.I.C., the Commission's road engineer.

James White, M.E.I.C. is in Washington in connection with his Labrador boundary investigations.

F. H. Kitto, M.E.I.C., exploratory engineer of the Natural Resources Intelligence Branch of the Department of the Interior, has returned to Ottawa after a season spent in the MacKenzie District and at British Columbia coast points. The preceding season he descended the Mackenzie to its delta and returned via the Alaska-Yukon route.

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During August, 1920, the Imperial Oil Company., which had been drilling in the Northwest Territories, below Norman, struck oil at a depth of about 800 feet. Not knowing the capacity of the well The Imperial Oil Company did not commit themselves in regard thereto, but during this time many applications had been received by stakers, who had treked in by dog team.

Early in the Spring of 1921, the Government commissioned O. S. Finnie, M.E.I.C., to establish administration and Mining Recorder's offices at the most strategic points where staking was likely to occur. In May, D. L. McKeand and L. T. Burwash left Peace River on two scows, with a party of 21 men, fully outfitted, to establish whatever buildings might be necessary. For months the officers of the Department of the Interior, under the direction of Mr. Finnie, had prepared this party and there was nothing lacking, insofar as office supplies, food, building material, blacksmith outfits and every available commodity necessary for the party and for the work in hand. After three weeks journey down the Peace and Slave rivers the party arrived at Fort Smith, on the 23rd May. Mr. Finnie joined the party early in June and, with Mr. McKeand, supervised the recording of claims, the surveying of lots, the organization of office staff, and incidently the installation of the first bank at Fort Smith. Mining Recorder offices at Norman, Resolution and Fort Smith, have handled, and will continue to handle, all Government business relative to oil, gold, silver or any other resources administered by the Dominion Government. Proceeding by steamer Mr. Finnie and Mr. MacKeand took the census interviewed the heads of the different companies engaged, in trade, and met the natives and heads of the different religious bodies, as far North as McPherson, a hundred miles or more within the Arctic circle.

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At Washington, D.C. on Wednesday October 5th. John Murphy, M.E.I.C., past Council of the E.I.C., presented his address entitled "Ice Formation and Prevention with" Special References to Frazil and Anchor Ice", to the Washington Society of Engineers. The meeting was held at the Cosmos Club and was largely attended. Officials of the United States Federal Water Powers, Irrigation, Reclamation and Geodetic Services took part in the discussion which followed the presentation of the address. The Washington engineers and scientists who attended the meeting showed great interest in Mr. Murphy's lantern slides and unique motion pictures and tendered him a hearty vote of thanks after he had answered a host of questions. Our neighbours to the South are becoming greatly interested in the Ice Question now that the devlopment of their Northern water powers is becoming of so much economic importance to them. Captain Robert L. Faris, the President of the Washington Society of Engineers in introducing their guests, said:-

"Mr. *Murphy* is going to tell us all about *Ice* - and *I* am going to let him tell it."

Secretary Keith, "Who never sleeps," caught Mr. John Murphy in New York on his return from Washington and induced him to represent the E.I.C. at the Engineers' Peace Dinner at the Pennsylvania Hotel on Monday evening, October 10th.

Montreal Branch

J. L. Busfield., A.M.E.I.C., Secretary-Treasurer.

Visit to Aqueduct

The 1921-22 season commenced with great éclat on October 6th, with a visit to the Montreal Water Works Aqueduct as guests of the Water Board of Montreal. A party of nearly one hundred members left *The Institute* headquarters in special motor busses and private automobiles at two o'clock. Proceeding to the aqueduct crossing of the Lasalle Road at the new bridge where they were met by the members of the Water Board, Messrs. Doucet, Francis and Lea, and the engineer in charge Mr. DesBaillets, the party examined the headworks and the whole of the aqueduct, finishing at the pumping station at Atwater Avenue. Many were the expressions of satisfaction at the neatness of the finished work, and the rapid progress being made by the contractors, especially with regard to the foundation of the new pumping station the concrete for which had already been laid, although the contract had only been let four days. The new electric pumps which were operated to full capacity of over 75 million gallons per day were objects of particular interest. Mr. Francis explained the principal features of the work as the excursion progressed and pointed out that the recent improvements had resulted in the reduction of nearly one hundred persons in the pumping station staff and saving of nearly half a million dollars per annum in the pumping station.

At the regular evening meeting, A. E. Doucet, M.E.I.C., read the first of the series of the papers of the Montreal aqueduct dealing particularly with the history of the aqueduct scheme. There was an attendance that taxed the capacity of the hall, the chair being taken by J. H. Hunter, A.M.E.I.C., who briefly welcomed the members for the resumption of their activities after the summer vacation.

Mr. Doucet's paper will be printed in a later number of *The Journal.*

Appreciation of R. A. Ross, M.E.I.C.

Following the reading of the paper a resolution of appreciation to R. A. Ross, M.E.I.C., for his self-sacrificing work in the interests of Montreal while connected with the Administrative Commission of the city was proposed by by W. F. Tye, M.E.I.C., and seconded by J. A. Duchastel, M.E.I.C., Mr. Tye moved that "the Montreal Branch of *The Engineering Institute of Canada* place on record its deep apreciation of the services which R. A. Ross, M.E.I.C. has rendered to the citizens of Montreal during the time he has acted as a member of the City Administrative Commission. In so doing we would acknowledge the debt we owe to our colleague who sacrificed his own personal wishes and interests when he responded to the unlooked-for and somewhat abrupt appointment by the Quebec Government. In accepting that position, he threw up his professional work and prospects, and the engineering profession appreciates the fact that he considered the good of his fellow ciitizens before his own professional advantage. For the faithful and painstaking performance of his duty under the trying circumstances connected with municipal affairs we tender Mr. Ross our sincere thanks, and extend to him the good wishes of the engineering profession for a prosperous and successful return to his private practice," and in addition Mr. Tye said that "members of the engineering profession particularly appreciated the good work for the city that had been done by Commissioner Ross, a work which was not as yet properly appreciated by the citizens generally, since Mr. Ross was not given to advertising himself. Mr. Ross had undertaken this work for the good of the city, and his colleagues in engineering work could understand how much he had sacrificed in his own work by giving up his practice and devoting his time to the civic welfare, in which he had done excellent work." "Mr. Ross", said Mr. Tye "had also done at the same time notable national work on the Lignite Board of Canada which had come well along toward solving the fuel problem in the West and had also been engaged in solving the peat problem for Ontario, all this service being done gratuitously. By these services Commissioner Ross has done work both for the city and for the whole country which deserve marked recognition from this Institute" concluded Mr. Tye, "and I have great pleasure in moving this vote of appreciation".

Commissioner Ross in replying said that he had been completely taken by surprise by the resolution. He however expressed gratification that his efforts for the good of the city had met with the approval of his engineering colleagues. In a humorous vein he spoke of his experiences at the City Hall, remarking that they had completely upset all engineering standards which demanded truth and facts. In civic public life things seemed to run on a different basis, and the results might be apt to make men somewhat cynical. Now, or soon, he would return to his profession, where reason, common sense and facts where the basis of action. But before leaving office said Commissioner Ross he wished to express his profound gratitude for the continual kindness and courteous consideration he had met as the only English-speaking Commissioner from the French-speaking members and others at the City Hall, a consideration which he doubted would have obtained had the position been reversed. The Board had had some rough and unpleasant work clearing out undesirables and heelers, but there had never been a real row, and he had learned a vast deal during his period of office. "However we have been kicked out and go at the end of the month", concluded Commissioner Ross. "But I do not think we have made a failure, and I must thank you of the engineering profession for the kindly words of appreciation you have spoken with regard to my own efforts." (Applause).

Presentation of Gzowski Medal

Another feature of interest at this meeting was the presentation of the Gzowski medal to R. de L. French, M.E.I.C., for his paper on design and construction of Reinforced Concrete Covered Reservoirs. The medal was presented by Walter J. Francis, M.E.I.C., who explained that for thirty years this medal has been given to the member presenting the most meritorious paper before *The Institute* on technical subjects. The terms of the bequest were that if no paper should have been adjudged worthy of it, the medal should not be awarded. But, said Mr. Francis, it was to the credit of the profession that there had never been a gap. This year he was particularly pleased to present the medal to Mr. French, a Montreal engineer, for his extremely valuable paper on reinforced concrete covered reservoirs. Mr. French replied in a few well chosen words of thanks.

Montreal Branch Luncheon in Honour af Doctors Colpitts, Corless, Duggan, Johnson, Macphail and Porter.

On October 13th, the Montreal Branch gave a luncheon in the Canadian Pacific Dining Room, Windsor Station, in honour of the six members of *The Institute* upon whom McGill University was conferring the honorary degree of Doctor of Laws during the Centenary celebration. The six honoured guests were: Walter William Colpitts, M.E.I.C., of the firm of Coverdale and Colpitts, New York; Charles Vandyke Corless, M.E.I.C., Mond Nickel Company; George Herrick Duggan, President, Dominion Bridge; Phelps Johnson, M.E.I.C., president, St. Lawrence Bridge Company; James Alexander MacPhail, M.E.I.C., Queen's University, Kingston; and George Frederick Porter, M.E.I.C., Canadian Bridge Company, Walkerville.

Walter J. Francis, M.E.I.C., toastmaster, in proposing the toast of The King, said that Old McGill, at her centenary, had not confined her honors to her own sons and in the engineering profession she was honouring six, three of whom were from McGill, W. W. Colpitts, C. V. Corless and J. A. MacPhail, one from Toronto, G. H. Duggan, two, P. Johnson and G. F. Porter from the great university of experience.

Brigadier-General C. J. Armstrong, M.E.I.C., commanding Military District No. 4, in a brief speech overflowing with enthusiastic appreciation for McGill, proposed the toast of "Old McGill" as a graduate of the Royal Military College, Kingston. The toast was responded to by all of the 130 graduate guests present, who joined with hearty vigour in singing "McGillitis," a characteristic collection of college songs arranged specially for the occasion.

"Our Guests" was proposed by J. H. Hunter, M.E.I.C. Chairman, Montreal Branch, Engineering Institute of Canada.

Walter W. Colpitts, M.E.I.C., of the firm of Coverdale and Colpitts, New York responded. He expressed his sincere appreciation of the honour to be bestowed on him that afternoon and referred to the work accomplished by McGill graduates in every corner of the globe, and especially in Southe American countries, where probably they had reached the peak of their fame.

Charles V. Corless, M.E.I.C., another graduate receiving the distinguished honor in acknowledging the toast referred to the old days at McGill. He referred in general way to the part that McGill University had played and was today playing in the educational field, graduating men who in their accomplishments and ability were second to none. Speaking from personal experience, he made mention of the roll that McGill men had played in the development of the nickel industry in this country and elsewhere.

The menu for the occasion was recorded as follows:

"Ye LL.D's of serious mien,
And guests of varied mould,
Your presence here must surely mean
That you some food can hold!
So, to prepare your appetite
For solid fare to come,
A sprig of celery so white
Is set with sour, green plums.
Presumably, ere entering here,
A cocktail each has had—
Si non, you may enjoy a beer
If your loose coin's not bad.
A few, no doubt, are canny Scots,
So broth for them is set—
This simply means that empty spots
Will soon be full of wet!
And, following that, dear Mary's lamb
Has sawn off half a leg.
And garnished it with mint, bedam,
For more to make you beg.
To round your tummies out so tight
Are spuds (or eke "patates")
With spinach (English) in its might—
('Twill never make you fat.)
The next course—"Salade panachée"—
Means simply varied things
Like lettuce green, tomatoes red,
The waiter quickly brings.
By this time, surely you will be
Quite ready for a sweet,
So, haply, ice-creamed-pie you'll see
So tempting cool and neat.
To finish up, ere smokes begin
Black coffee on the card
So plan just so and you will win
Peace, health and our regard.

Dr. George H. Duggan, M.E.I.C., who has already received the honorary degree of LL.D. from Queen's University, Kingston, and Toronto University, also voiced his appreciation of the toast. He had accepted the honour as one which was really conferred on the engineering fraternity as a body.

Phelps Johnson, M.E.I.C., paid a sincere tribute to the work of McGill. He appreciated the expression of goodwill which was in evidence on all sides on this glorious occasion on the centenary of McGill.

Colonel James A. MacPhail, M.E.I.C., in a characteristic speech, referred to the bond of love existing between the Universities of Queen's and McGill, and the keen pleasure he was experiencing in the reunion.

George F. Porter, M.E.I.C., who followed Colonel MacPhail, thanked the Montreal engineers for the hearty compliment paid him and his fellow guests.

"The Doctor's Chant," "Saw My Leg Off" was received with hearty cheers. "Mr. McDonald the Husbandman" was another chant which met with appreciation. The luncheon closed with the singing of "My Country Tis of Thee." (in compliment to the guests from across the line), and "God Save the King."

Moncton Branch

M. J. Murphy, A.M.E.I.C., Secretary-Treasurer.

The interesting development of the science and construction of air craft was the basis for a pleasant and instructive story in City Hall, on Thursday Evening Oct. 6th, when the Moncton Branch filmed nine pictures, which had been loaned to them by the Canadian Air

Board. The pictures, which were excellent ones were primarily war films taken by the British air ministry, partly for instructional purposes and partly for propaganda work.

The films shown were:—
1st.—Flying boats and seaplanes.
2nd.—Aerial compasses.
3rd.—Theory of flight.
4th.—Torpedo Dropping
5th.—H. M. S. "Carmania."
6th.—Theory of flight (Part IV.)
7th.—The ring sight.
8th.—Tails Up. France
9th.—Surrender of the German High Sea Fleet.

All the films were instructive, but mention is made of the film showing the construction of flying boats and seaplanes, as well as the animated films showing the theory of flight. These illustrated the construction, the erection, and operation of seaplanes and airplanes. Types of engines were given and other films illustrated the many types of machines which the Allied armies had in France and on the high seas.

All films were secured by H. J. Crudge, A.M.E.I.C., Engineer of buildings of the Canadian National Railways.

As many of the films were being shown, Flight Lieut. H. N. Price explained to the onlookers various interesting facts in connection with the pictures before them.

The fifth film was exceedingly clear and interesting. Here was shown seaplanes being hoisted out of H. M. S. "Carmania", their take off from the flying deck and their return to the ship. The process of lowering them into the hold was very interesting.

The close up views of the German High Sea fleet gave an onlooker a good idea of the nature and extent of the Hun armament.

During the evening Mrs. Harold N. Price rendered a beautiful solo. She was very heartily encored and responded with another very beautiful selection. Thomas Stenhouse also favored the audience with two selections which were much enjoyed. Both where heartily encored. Major McKee accompanied both soloists.

The meeting at which J. D. McBeath, M.E.I.C., assistant city engineer, presided, was open to the public. There was a fairly large attendance, but if the public had known how interesting the films were they would not have missed the exhibition.

St. John Branch

Harry F. Bennett, A.M.E.I.C., Secretary-Treasurer.

The first regular meeting of the season of the St. John Branch was held in the Orange Hall on Oct. 20th. In the absence of the Chairman ,A. G. Tapley, A.M.E.I.C., occupied the chair. After the regular business, K. H. Smith, M.E.I.C., of Halifax, district engineer of the Water Powers Branch, spoke on "Power Development in the Maritime Provinces".

Mr. Smith showed a lantern slide on which was shown a net-work of proposed transmission lines and power stations covering New Brunswick and Nova Scotia. Some of these were in operation, others were under construction, and, he added, he was of the opinion that we would not have to wait very long before the idea was fully realized. Electric power would then be available for industrial purposes all over the provinces and it was not too much to expect the electrification of the Canadian National lines. It was possible, Mr. Smith said, for 500,000 H.P. to be developed for commercial purposes within the three provinces.

Mr. Smith said that the Water Powers Branch of the Department of the Interior was assisting in every possible way the development of water power. This Department was responsible for the water resources of Western Canada and it was a natural thing for the same branch to take up the examination of power possibilities in the other provinces where the actual resources were controlled by the provincial governments. Extensive stream measurement work was a fundamental and necessary work preceding the establishment of any water power development scheme. This work was of a routine nature and at times tedious for those engineers who had the work in hand; it was not always fine weather when stream measurements were taken.

The New Brunswick and Nova Scotia Power Commissions were organized to carry out the actual work of obtaining hydro-electric power. There had been close co-operation between the provincial and federal departments, in fact they all worked together, practically as one unit. The best powers, most suitable for our purposes, are those which produce from 3,000 to 10,000 horse power, as it was not advisable to develop, at present, such powers as Grand Falls with 60,000 H. P. when the nearest market was 200 miles away and even that could not use a great quantity.

In view of all this potential electrical energy, well distributed over the provinces, there had grown up a general opinion that some day, all these units would be incorporated into one transmission system supplying power to all parts of the Maritime Provinces.

Mr. Smith said it was not necessary to convince an audience of engineers of the feasibility of hydro-electric power development projects in these provinces, but he had often found that the lay mind was somewhat scepical. He had found it necessary to show pictures of similar schemes, already operating, to convince them that they had plenty of latent power right in their midst. There was no necessity of having a Niagara Falls to get water power.

Mr. Smith closed his address with a pictorial description of the St. Margaret's Bay plant in Nova Scotia. He pointed out the similarity of this plant and the works at Musquash, New Brunswick, and the general features of construction.

At the close of the paper, C. O. Foss, M.E.I.C., chief engineer of the N. B. Power Commission spoke of the assistance Mr. Smith had given their commission and the help their stream measurements were to them in their study of power possibilities.

A vote of thanks moved by C. C. Kirby, M.E.I.C., and seconded by H. F. Bennett, A.M.E.I.C., was extended to Mr. Smith by the Chairman.

Halifax Branch

O. S. Cox, A.M.E.I.C., Secretary-Treasurer.

Papers for Halifax Branch of Engineering Institute of Canada

Season 1921-22

October	1.	Talk by Dr. F. H. Sexton, N.S. Technical College on his trip to Europe, with a description of reconstruction in France after the War.
November	1.	Tramway Engineering by I. P. MacNab, M.E.I.C., N.S. Tramways & Power Co., Ltd.
	2.	(Paper E. Suggested)
December	1.	Town Planning—H. W. Johnston, S.E.I.C., Asst. City Engineer, Halifax, N.S.
	2.	(Paper B. Suggested)

January	1.	Some of the Problems met with in Local Building Constructing—by C. St. J. Wilson, A.M.E.I.C., of Pickings & Roland.
	2.	(Paper C. Suggested)
February	1.	Paper from Dept. of Public Works.
	2.	"A Lump of Coal"—Ken. Dawson, Jr.E.I.C., N.S. Tramways & Power Co.
March	1.	Engineering Underground in France—R. R. Murray, M.C., Provincial Highways Board.
	2.	(Paper C. Suggested)
April	1.	Some of the Problems met with in Surveying—H. B. Pickings, A.M.E.I.C., of Picking & Roland.
	2.	(Paper F. Suggested)
May	1.	The work of the Municipal Engineer—F. W. W. Doane, M.E.I.C., City Engineer, Halifax, N.S.

Town Planning Notes and Comments

H. L. Seymour, A.M.E.I.C.

NOTE:—*In order to make this column of wide interest to members of The Institute, personals and items of town planning interest will be appreciated. Address: H. L. Seymour, A.M.E.I.C., 40 Jarvis Street, Toronto.*

Town Planning Conference, Montreal

Mention was previously made in these columns of the Montreal Town Planning Convention and Exhibition under the joint auspices of The Town Planning Institute of Canada and the City Improvement League of Montreal. This congress took place at the Place Viger Hotel, Montreal, on September 29th, 30th., and October 1st.

In last month's Journal of *The Engineering Institute of Canada* editorial comment was made on the important part taken by the members of *The Engineering Institute of Canada,* a great majority of the addresses being given by corporate members. To Jas. Ewing, M.E.I.C., of Montreal, Vice-President of the Town Planning Institute of Canada and an active member of the Montreal City Improvement League, must be given a great deal of credit for the success of the conference. A matter of significance is that at the morning session on Friday, September 30th., Walter J. Francis, M.E.I.C. Vice-President of *The Engineering Institute of Canada,* was chairman. Needless to say he performed his duties in his usual capable manner.

Considering the conference as a whole, it would seem to merit the remark made by Dr. W. H. Atherton, Secretary of the City Improvement League at the close of the Convention, that whereas he had attended many town planning conventions and conferences in the States, he was impressed with the fact that the papers and proceedings had been of a standard equally as high as any attained in conferences across the border. He felt that we had now developed town planners in Canada, who could well hold their own in the town planning field.

Special attention was given at the Conference to Montreal city planning problems. resolutions were passed requesting the civic authorities to take advantage of legislation for the appointment of a City Planning Commission, and suggesting co-operation with surrounding municipalities.

City Planning in Canton, China

The urge for city planning is not confined to Montreal, this country or the Occident, as a letter from the mayor of Canton, China, to the mayor of San Francisco California, demonstrates. The letter of the mayor of Canton, according to the "National Municipal Review," is as follows:

> In consequence of the recent demolition of our old city wall, the Canton municipality, an administration just lately established, has as its major functions the remodelling of the city of Canton along modern lines.
>
> We realize that the experiences of city building that have been acquired by the more advanced cities of Western countries would give us invaluable hints in our present stage of municipal development.
>
> Hence, it is the earnest desire of this municipality to profit by such an advantage.
>
> I, therefore beg to request your kindness to lend us a helping hand by furnishing this office with a map of your city, together with such other publications or illustrations concerning or showing your schemes of street planning, drainage, sewerage, playgrounds, civic centre, water supply, bridges, water front, electric light, street illumination and tramway system, etc.
>
> I earnestly hope that our request may be favoured, and thanking you in anticipation,
>
> I have the honour to be, Sir,
>
> Yours respectfully,
> (Signed) SUN FO, Mayor.

City Planning Commissions

The following information supplied by Hugh E. Lynch, secretary of the City Planning Commission, Grand Rapids, Michigan, is illustrative of city planning development in the United States, and may set an example to some of our Canadian municipalities:

> On July 21, 1919, the mayor of Grand Rapids appointed a City Planning commission of five members. The first year was devoted largely to investigation. The beginning of the second found the organization in healthy shape and endeavoring to obtain sufficient recognition to secure the preparation of a comprehensive city plan.
>
> On June 21, 1921, the City Commission closed a contract with Harland Bartholomew of St. Louis, to prepare such a plan within two years. Meanwhile the Planning Commission has been increased to nine members, by the addition of four department heads from the city government, namely, the directors of public service and public welfare, the city engineer and the superintendent of parks. It has been given standing as a city department with a full-time secretary employed."

Housing Shortage and Taxation

To combat the housing shortage, one of the byproducts of the war, the legislature of New York State passed in September, 1920, a tax exemption law allowing municipalities exemption for ten years from local taxation on new buildings erected for dwelling purposes. On February 25th, the Board of Estimate and Apportionment of New York City set their seal of approval on tax exemption for their city.

The ordinance, as enacted, provides for the exemption from local taxation until January 1, 1932, all new buildings planned for dwelling purposes whose construction was completed since April 1, 1920, or if not so completed, whose construction was commenced before April 1, 1922,. Such exemption is granted to the extent only of $1,000 for each living room, including kitchens, but the total exemption shall not exceed $5,000 for each single family house, or for each separate family apartment.

According to Henry H. Curran, president of the Borough of Manhattan, building permits have increased 216 percent. during 1921 as contrasted with similar periods of the year 1920. He states that since the enactment of the exemption ordinance, plans for an average of more than 1,000 homes a week have been filed. He views with pleasure the fact that a great many of these are the small one and two family houses rather than apartment houses.

To the builder, he believes, the tax exemption ordinance has meant that much, if not all, of the increased cost of building over normal conditions is written off. Careful estimates place the saving at 35 percent of the cost of construction.

Preliminary Notice

of Applications for Admission and for Transfer

19th October, 1921

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate member a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in November, 1921

Fraser S. Keith, Secretary.

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*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option, Railway, Municipal, Hydraulic, Mechanical, Mining or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects. Geography. History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits cientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

AUSTIN—REGINALD DE BRUNO, of Toronto, Ont. Born at Guildford, Surrey, England, April 2nd, 1884; 1900-05, prem. ap'tice, Boyne Engine Works, Leeds, England; 1905-07, asst. mech. engr., Geo. Pauling & Co., Ry. Contractors, London, England; 1907-09, in mech. production dept. and 1909-13, sales engr., Canada Foundry Company; 1913 to date, Secretary, Turbine Equipment Company, Limited, Toronto. Also acts as engr. and responsible for all engr'g. contracts obtained by the company.

References: R. O. Wynne-Roberts, W. Chipman, J. Milne, P. H. Mitchell,

BARNETT—THOMAS ARTHUR, of Falls View, Ont. Born at Niagara Falls, Ont., Jan. 1st, 1875, 1892-93, rodman, Niagara Falls Park & River Rly.; 1893-97, instr'man, Elect'l Development Co., 1898, instr'man., for James Wilson, Niagara Falls Park, 1910 and 1912, town engr., Maple Creek, Sask., Part of 1911, charge of field work under C. M. Arnold, City of Lethbridge, Alta., 1911-15, supt. at Nairn Falls power house and dam, Mond Nickel Co., 1916-17, constrn. engr. and supt. at Creighton Mines for Canadian Copper Co.; 1917-18, supt. for H.E.P.C. at Healey Falls, 1919, res. engr. and supt. for H.E.P.C. at Eugenia New Unit; At present, gen. supt., Morrow & Beatty, at Twin Falls power house and dam.

References: J. A. Beatty, T. H. Hogg, H. G. Acres, H. L. Trotter, W. B. Crombie.

DRAPER—CHARLES FREDERICK, of Montreal, Que. Born at Blackrock, Ireland, Nov. 26th, 1876; Educ., Bach. of Engr'g. (B.A.I.), Trinity College, Dublin, 1899; M.A. Trinity College, Dublin, 1902. Pupil of late Carter Draper, M.I.C.E., design and constrn. of bridges and roads; 1900-03, asst. engr. with War Office, London; 1903-04, asst. engr. P.W.D., India irrig. work; 1904-11, asst. to chief engr., Great Southern & Western Rly. In charge of chief engr's drawing office and design of all works; 1915-19, overseas, Capt. and Major Royal Engrs., O.B.E.; 1911 to date, asst. engr. of bridges, C.P.R. At present, res. engr., C.P.R. cantilever bridge, St. John, N.B.

References: J. M. R. Fairbairn, P. B. Motley, H. H. Vaughan, G. H. Duggan, F. P. Shearwood.

HARRISON—NOEL FAURE, of Norwood Grove, St. Boniface, Man. Born at Dromore, Co. Down., Ireland, Dec. 25th, 1884; Educ., private tuition, mech. drawing and mach. design; 1903-06, articled pupil to Messrs. Norman Robinson & Brunker, Electr'l Engrs., Dublin, Ireland; 1902-03, arch'l. drawing & bldg. constrn., office of Sir Thomas Drew, Dublin; 1906-07, asst. to H. Ross, elect'l contractor, Winnipeg, Man.; 1907-08, dftsman. with J. C. Royce, consltg. Mech. Engr., Toronto; 1908-09, chief (designing) dftsman., J. P. Farrelly Excavating Machine Co., Toronto; 1909-10, asst. to the late Roderick J. Parke, Consltg. Elect'l Engr., Toronto; 1910-19, office of the chief engr., C.N.R., Winnipeg, attached to the arch'l dept. as asst. to the arch't. in charge of the preparation of wiring layouts and specifications for the electric lighting of stations etc., the design of mech. cooling plants, etc., 1920 to date, general engr'g. work in connection with power transmission under J. Rocchetti, chief engr., Manitoba Power Comission, Winnipeg.

References: G. DeW. Archibald, A. G. Connell, J. Rocchetti, F. H. Martin, J. C. Street, D. A. Ross, H. C. D. Briercliffe.

HARTLE—FRANCIS STEWART, of Winnipeg, Man. Born at Sheffield, England, Oct. 28th, 1898; 1913-15 (18 mos), ap'tice engr., in England, 1915-18 and 1919-20 (4 yrs) ap'tice machinist, C.P.R.; 18 mos. locomotive dftsman., C.P.R.; 1918-19, (1 yr) engine room artificer, R.N.C.V.R.

References: J. Lee, G. R. Pratt, J. A. Douglas, H. W. McLeod, L. Picrard.

HENRY—THOMAS HALIBURTON, of St. Catharines, Ont. Born at Montreal, Aug. 17th, 1892; Educ., B.Sc., McGill Univ., 1914; 1914-16, transportation student, C.P.R.; 1916-19, overseas; 1919-20, car service dept., C.P.R.; 1920-21, inside and outside work, T. Pringle & Sons Ltd., Montreal; From Sept., 1921, asst. engr., J. P. Porter, Standifer & Porter Bros., St. Catharines, Ont.

References: G. M. Wynn, J. S. Costigan, A. C. Brown, H. Holgate, A. H. Milne.

LANIEL—JOSEPH ALBERT, of London, Ont. Born at Montreal, Oct. 29th, 1884; Educ., Ecole Polytechnique, 1906-10; 1908 (3 mos), dftsman., Ouimet & Lesage, Consltg. Engrs., Montreal; 1909 (3 mos), instr'man., P. W. D. Canada, Three Rivers, Que.; 1910-20, asst. engr., P.W.D. Canada, Fort William, Ont. 1910-15, in charge of dredgings & soundings, 1915-18, in charge of survey for harbour lines, 1919-20, in charge of constrn. of breakwater; At present, asst. engr., P.W.D. Canada, London, Ont.

References: K. M. Cameron, H. B. R. Craig, A. J. Stevens, W. J. Forbes-Mitchell, A. M. Kirkpatrick.

McGRAIL—THOMAS ERNEST, of Ottawa, Ont. Born at York, England, Jan. 3rd, 1882; Educ., Private Tuition, Montreal Technical School; 1898-1903, ap'tice to plumbing and heating; 1906-07, charge of plumbing & heating, St. Anns School, and No. 5 fire station, Montreal; 1907-11, charge of plumbing the John Murphy Building, and of plumbing and part heating and ventilation, Chateau Laurier, Ottawa; for the Garth Co., Montreal; 1911-21 (with exception of 1916-18, when overseas with Can. Engrs.), chief engr. for G.T.R. at Chateau Laurier, Ottawa; April 1921, to date, with the C. A. Dunham Co. (heating service), as engr., designing and supervising install'n. of heating & ventilation.

References: J. Murphy, J. A. Ewart, W. H. G. Flay, R. F. Uniacke, J. H. Forbes.

MONTGOMERY—THOMAS, of Sarnia, Ont. Born at Plympton Township, Lambton Co., Ont., July 5th, 1874; Educ., mech. engr'g. course, I.C.S.; From 1897 to date with Imperial Oil, Limited; 1897-1915, mech. supt. in charge of mech. and engr'g. dept. of the Sarnia plant. Also charge of all constrn.. In 1915 appointed chief engineer, and in addition to above mentioned duties, in charge of preparation of plans and of constrn. Also special work in designing of refinery equipment, bldgs., wharfs, pipe lines, sewerage & waterworks systems, steam and electric power equipment etc.

References: E. L. Cousins, L. A. Thornton, St. G. J. Boswell, F. W. Thorold, G. C. Parker, C. D. Dean, E. D. A. Gray.

ROBINSON—WILLIAM CECIL ELWOOD, of Coldwater, Ont. Born at Coldwater, Ont., Nov. 12th. 1891; Educ., Junior matric., 1906. Junior teacher, 1908; 1909-10, C.P.R. constrn. dept., Port McNicoll; 1910, rodman, J. S. Metcalfe Co., Port McNicoll; 1912, rodman, constrn. dept., 1913, (mtce.) instr'man., C.P R.; 1914, instr'man., C.L.O. & W.Ry.; 1915-19, overseas, Lieut., R.F.A.; Nov. 1919 to date with L.E. & N. & G.R. Rlys., 1919, asst. engr., 1920 (Jan.-May), acting chief engr., and May 1920 to date, asst. engr.

References: F. H. Midgley, D. Hillman, H. Wellwood, G. Rayner, W. E. P. Dunbar.

SNELL—SIDNEY, of Toronto, Ont. Born at Sheffield, England, Jan. 24th, 1892; 1 year pupil engr., Marshall's Limited, Engrs., Gainsboro, England; 5 years ap'tice mech. engr., under H. A. Ivatt, M.I.C.E., chief engr., Great Northern Rly., England; 2 years engr. in charge (for contractor) of new plant and foundations for same, Hadfields Ltd., Engrs., Sheffield, England; 2 years, contractors field engr. on public works in England; Overseas, Officer commanding 89th Field Coy., R.E., Major; 1920 (May-Dec.), asst. engr. in charge of valuation dept., G.T.R.; 6 mos. advisory engr. to J. A. Grayson, vice-pres. and gen. mgr., Jessop Steel Co. of America; At present gen. mgr. and engr., British American Fuel & Metals Ltd., Toronto.

References: W. Storrie, N.M. McLeod, T. D. Mylrea, J. M. Oxley, R. O. Wynne-Roberts.

TAIT—JOHN LEMOIRREY, of St. Lambert, Que. Born at Port St. Marty, Isle of Man, Britain, Feb. 28th, 1885; Educ., Glasgow & West of Scotland Technical College; 1900-05, ap'tived to mech. engr'g. and 1905-11, in struct'l drawing office, Sir Wm. Arrol & Co. Ltd., Glasgow; 1911-14, dfting office, Maritime Bridge Co. Ltd., New Glasgow. N.S.; 1914-19, dfting & design, bridge dept., C. N.R.; 1919-21, charge of struct'l steel design, reinforced concrete design and constrn. specifications, Lockwood Greene & Co. of Canada Ltd; At present Consltg. engr.

References: W. A. Duff, C. B. Brown, H. G. Hunter, H. W. Fairlie, M. J. Murphy, E. G. Horne.

TRAINER—DAVID, of Calgary, Alta., Born at Thurlow, Penna., U.S.A., March 6th, 1871; Educ., Special science course completed 1892, Univ. of Mich.; 1893-98, building various cotton mills in South Carolina and Alabama; 1898-1900, had charge of Carnegie Steel Co.'s New York City large building structural steel dept.; 1900-03, chief purchasing agent, International Nickle Co.; 1903-05, pres. and gen. mgr., Alma Portland Cement Co., Wellston, Ohio; 1905-06, subcontractor on 12 miles (mountain section), double tracking Louisville & Nashville Rly., tunnel work, fills, cuts, retaining walls, bridges, culverts, etc.; 1907-09, pres. and gen. mgr., Western Steel & Iron Co., Winnipeg; 1909 to date, (with exception of time in France with Can. Engrs.) building contracting business in Calgary. At present contracting for modern buildings and especially reinforced concrete work of all kinds.

References: F. E. Emery, F. Lee, J. R. Cosgrove, D. J. Carter, C. Ewart, C. K. Brown, W. G. Swan, F. K. Beach, V. A. Newhall, J. L. Doupe.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

JANES—PERCY OSCAR GORDON, of Toronto, Ont. Born at Bury, Lancashire, England, Jan. 31st, 1885; Educ., 1899-1906, 7 years ap'ticeship to mech. engr'g., and studying at Bury & Salford Technical Institutes. 6 year course at Manchester School of Technology; 1908-09, dftsman and engr. on steam engines, Gallaways Ltd., Manchester; 1909-11, chief dftsman, on steam turbines, with Daniel Adamson & Co.; 1911-12, dftsman and 3mech. engr., T. Pringle & Sons, Engrs., Montreal; 1912-16, engr. and specialist for design and application of SKF Beatty's for Canada, with Canadian Fairbanks-Morse Co. Ltd., (sole Agents); 1916 to date, vice-pres., gen. mgr., and chief engr, for Canadian SKF Company Ltd., Toronto and Montreal.

References: J. S. Costigan, E. A. Jacobson, I. H. Nevitt, C. B. Hamilton, Jr., W. Chipman, F. S. Keith.

WHITTAKER—DAVID, of Edmonton, Alta. Born at St. Helen's, Lancashire, England; Sept. 23rd, 1884; Educ., Liverpool Univ.; 1909-10, transitman & reconnaissance engr., Alberta & Great Waterways; 1910 (May-Nov.), C.N.R. office; 1910-13, res. engr., Kootenay & Alberta Ry.; 1913 (May-Nov.) res. engr., C.P.R.; 1914 (Mar.-Aug.), res. engr., Greater Winnipeg Waterways; 1915-19, overseas. Lieut. R.E.; 1919 (July-Aug.), transitman on location, C.P.R.; Sept. 1919 to date, asst. hyd. engr., reclamation service, dept. of the interior, Edmonton, Alta.

References: J. S. Tempest, G F. Richan, F. M. Steel, J. G. Reid, C. Flint, H. B. Sims, P. J. Jennings, A. E. Sharpe.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

ANGELL—HENRY GERALD, of Bassano, Alta. Born at Guildford, Surrey, England. Oct. 27th, 1885; Educ., Senior Cambridge Cert., 1901. Admitted by exam. to Surveyer's Institute, London, England, 1904; 1903-06, articled pupil with S. J. Newman, F.R.I., B.A., Borough Engr., Poole, Dorset., England; surveyor with Messrs. Homsteads Ltd., London, England; 1906-09, chief asst. engr. to J. Chapple, Chile, on topog'l surveys, irrig. and marine surveys in Chile and Argentine; 1910 to date with C.P.R. in the following capacities:— 1910, dftsman., mtce. and operation, Montreal, 1910-11, asst. engr. D.N.R., eastern section irrig. project, in charge of parties on topog'l surveys and constrn., office engr. on above project during constrn., 1917 to date, canal supt. in charge of the Bassano division of the above project.

References: A. S. Dawson, H. B. Muckleston, P. J. Jennings, S. G. Porter, C. M. Arnold, M. H. Marshall, R. S. Stockton.

BARNES—CHILES MANLY, of Buffalo, N.Y., U.S.A. Born at Boulevard, Virginia, Aug. 26th, 1888; Educ., 3 years W. & M. College, Williamsburg, Va 4 mos. special course, Iowa State College; 1907 (May-Nov.), tracing detailling, Virginia Bridge & Iron Co., Roanoke, Va.; 1909-12, detailling with the above company and Roanoke Bridge Co., and Omaha Struct'l Steel Works; 1912-13, detailling and checking, American Bridge Co., Gary, Indiana; 1913-17, detailling & checking, Eastern Canada Steel & Iron Works Limited, Quebec, Que,.; 1917-20, detailling, checking and designing, Newport News Shipbldg. & Dry Dock Co., Newport News, Va.; At present, checker with Lackawanna Bridge Co., Buffalo, N.Y.

References: F. T. Cole, A. B. Normandin, O.V. Johnson, I. E. Vallee, E. S. T. Lavigne.

BERRY—BYRON CONRADE, of Toronto, Ont. Born at Toronto, July 26th, 1888; Educ., 1906-08, S.P.S., Univ. of Toronto; 1907 (summer), rodman, C.N.R.; 1908, dftsman., and designer, Standard Ideal Co., Port Hope: 1909 to date (with exception of 1915-19 when overseas, with Artillery and Can. Engrs. Lieut.), with dept. of works, City of Toronto, as follows:—1909, rodman, roadway section, 1910-11, dftsman, instr'man and inspr., main drainage section, 1911-12, res. engr., i/c constrn., 3 sections high level interceptor, main drainage section, 1912-15, and 1919 to date, res. engr., sewer section.

References: G. G. Powell, G. Phelps, W. P. Near, W. R. Worthington, I. H. Nevitt, E. R. Gray, G. R. Jack, R. E. W. Hagarty.

BRIDGES—FITZ JAMES, of London, Ont. Born at Windsor, Ont., July 20th, 1887; Educ., 1907-08, 1st year engr'g. dept., Univ. of Mich.; 1905-07, patent office dftsman and mech. research work, for typograph work, office John Sale, Patent Attorney, Windsor, Ont.; 1909-12, drawing, estimating, designing, various reinforced concrete structures, head office. Trussed Concrete Steel Co., Detroit ; 1912 to date, in district engr's office, D.P.W. of Canada, Windsor & London, plotting surveys, estimating harbour works, supervising work under contract, inspecting work, etc., throughout district of western Ontario. Present position, junior engr., district engr's. office London district, D.P.W. of Canada.

References: H. B R. Craig, W. J. Forbes-Mitchell, A. J. Stevens, H. J. Lamb, M. E. Brian, J. E. Porter, J. J. Newman.

JOHN—BROOKE MOLESWORTH PARNELL, Lord Congleton, of Montreal. Born at Clomnel, Tipperary, Ireland; May 16th, 1892; Educ., B.Sc., McGill Univ., 1921. 4 years Royal Naval College, England. Qualified Gunnery Lieut., Royal Navy; 3 years midshipman, 1 year Sub Lieut. aud 6 years Lieut., Royal Navy.

References: J. B. Porter, C. M. McKergow, A. R. Roberts, J. C. Kemp, H. H. Vaughan.

DESLAURIERS—LOUIS WILFRID., of Montreal, Que. Born at Montreal, Feb. 13th, 1886; Grad. Civil engr., I.C.S. Member A.R.E.A.; 1902-08, dftsman & transitman, with J. P. Casgrain, L.S. and C.E.; 1908-12, checker of estimates & plans, N.T.C.Ry.; 1912-18, designer & checker, frogs, switches and track materials, and 1918 to date, asst, engr. in charge of designing, frogs, switches and track materials, C.P.R.

References: J. M. R. Fairbairn, J. W. Orrock, J. E. Armstrong, P. B. Motley, A. C. Mackenzie.

FAWCETT—SYDNEY DAWSON, of Ottawa, Ont. Born at Ottawa, Oct. 29th, 1882; Educ., 1 year McGill Univ. D.L.S.; 1903-06, rodman, leveller & instr'man, 1907, res. engr., G.T.P.Ry.; 1908-10, serving articles on Dom. Land Surveys; 1911-12, Dom. Land Surveyor under G. H. Blanchet; 1913-21, on various surveys and land classification parties in Western & Northern Canada; At present engaged by the topographical surveys branch, Ottawa, on land classification in the Beaver Hills Forest Survey, Saskatchewan.

References: B. Ripley, M. A. Burbank, G. H. Herriot, G. H. Blanchet, D. O. Wing, C. Rinfret, G. C. Cowper, W. H. Tobey.

FRASER—CHRISTOPHER EDWIN, of Toronto, Ont. Born at Brockville, Ont. June 7th, 1894; Educ., B.Sc., Queen's Univ., 1916; 1911 (June-Dec.), 1913 (May-Sept.) and 1914 (April-Aug.), rodman, ballast checker etc., N.T.C.Rly.; 1915 (summer), asst. to city engr., Brockville, Ont.; 1916-19, overseas. Lieut.—and Acting Capt., Can. Engrs.; 1919-20, chief asst. engr., Highway Dept., United Counties of Stormont, Dundas & Glengary, Cornwall, Ont.; 1920 (July-Nov.), with Warren Paving Co., as foreman and later as engr. for town as Brockville. laying asphalt pavement (Bitulithic); May 1921 to date, with James, Proctor & Redfern Ltd., Consltg. Engrs., Toronto, as res. engr. on paving and sewer constrn.

References: E. A. James, G. H. Bryson, J. G. Cameron, H. B. Stuart, W. P. Wilgar, T. S. Scott, K. Weatherbe.

GRIESBACH—WALTER, of Montreal, Que. Born at Collingwood, Ont. Aug. 23rd. 1891; Educ., B.Sc. Queen's Univ., 1912; 1910 (summer), rodman on O.L.S. under C. H. Fullerton; 1911 (summer), asst. topog'r. on geol. survey work on Vancouver Island; 1912-18, asst. engr., Public Works of Canada, Windsor, Ont.; 1918 to date, office engr., The Foundation Company Limited, Montreal.

References: H. J. Lamb, H. B. R. Craig, A. J. Stevens, R. E. Chadwick, C. W. Allen, L. C. Jacobs.

JENKINS—GEORGE AUBREY, of Portland, Oregon, U.S.A. Born at Orwell, P.E.I., Dec. 2nd, 1886; Educ., B.Sc. Queen's Univ., 1909; 1909 (May-Aug.), asst. engr., engr'g. dept., Edmonton, Alta.: 1909-10, instr'man on location, 1910, res. engr. on constrn., C.N.R. in Alta.; 1911-12, gen. constrn. foreman on street rly. & pavement constrn. in city of Calgary; 1912 to date, with Warren Bros. Company (Engineering) Laboratory as follows: 1912-13, district representative on control of street & highway constrn. work in states of Alabama, Mississippi, Georgia, North Carolina, Kentucky and Tenn.; 1913-19, same capacity in district comprising six other states and Sask., Alta and B.C., Canada, and 1919 to date, supt. in North West States and Western Canada where such work active.

References: W. M. Macphail, C. Brakenridge, J. N. Anderson, W. E. Jenkins, A. W. Haddow,.

KEEMLE—SAMUEL RALPH, of Chatham, Ont. Born at McConnelsville, Ohio, Sept. 25th, 1887; 1905-08, instr'man., etc., Mackenzie Mann & Co., Parry Sound-Sudbury; 1908-10, topog'r & levelman, Sudbury-Port Arthur; 1910-16, charge of location party, various surveys in Ontario and Quebec, MacKenzie Mann & Co.; 1916-20, chief engr., Caribbean Coal Co., geol. and rly. surveys and management constrn., Venezuela; August 1920 to date, chief engr., Chatham, Wallaceburg & Lake Erie Rly.

References: H. K. Wicksteed, A. F. Stewart, S. H. Sykes, E. T. Wilkie, H. T. Hazen, F. F. Clarke.

SHAW—CHARLIE BERFORD, of Iroquois Falls, Ont. Born at Pembroke, Ont., Oct. 14th, 1887, 1911, dfting, Burlington Steel Co.; 1912-13, in charge of instrument work and inspection, Ontario Paper Company Thorold Ont.; 1913-17, dftsman on design and detail, plans for Welland Ship Canal, St. Catharines, Ont.; 1917, with J. L. Weller, experimenting with reinforced concrete, 1918-21, chief dftsman, Riordon Company Limited, Hawkesbury, Ont.; Since Sept. 1921, in charge of dfting office, Abitibi Power & Paper Co., Iroquois Falls, Ont.

References: R. S. Kelsch, C. B. Thorne, J. L. Weller, W. H. Sullivan, J. F. Pringle, F. E. Sterns.

SHENSTONE—OSBORNE HARRIS, of Toronto, Ont. Born at Brantford, Ont., May 19th, 1887; Educ., B.S., Mass. Inst. of Technology, 1911, 1911-15, Vancouver & Districts Joint Sewerage & Drainage Board- 1911-13, instr'man & dftsman., 1913-14, chief dftsman and designer, 1914-15, res. engr.; 1915 to date (with exception of 1917-19 when overseas. 2nd Lt., R.A.F.), with Massey Harris Company, Toronto- 1915-17, designer, dftsman, & shop executive, 1919-20, asst. to supt. of Toronto factory, and at present supt. of Weston Works.

References: A. D. Greer, R. S. Lea, W. S. Lea, A.G. Dalzell, R. O. Wynne-Roberts.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

BENNET—WILLIAM HERBERT, of Kenora, Ont. Born at New Glasgow, Que. Aug. 25th, 1891; Educ., B.Sc. (C.E.), Queen's Univ., Sept. 1919; 1914, C P R. Angus Shops; 1916, John Bertram & Sons, Dundas; 1917, instr'man., La Loutre Dam, Quebec; 1917-19, overseas, R F.C.; 1919, instr'man Fraser Brace & Co., Montreal; 1920, asst. engr., J. A. White Eng. Corpn.; 1921, dfting, G T.R.; At present. res. engr., Backus Brooks Co. - Kenora Power Development - Kenora, Ont.

References: T. S. Scott, K. R. McLennan, C. M. McKergow, E. Brown, J. B. Porter.

BOAST—CHESTER WINFIELD, of Richmond, Que. Born at Richmond, Dec. 25th, 1893; Educ., B.Sc. (C.E.), McGill Univ., 1917; 1917-18, asst. engr., St. Maurice Constrn. Co.; 1918 (Mar.-Sept.), engr'g. dftsman. for the U.S.Govt. on constrn. of chemical plant in Virginia; 1918-20, struct'l dftsman & designer, Ford, Bacon & Davis of New York; Aug. 1920-Feb. 1921, with Lockwood Greene & Company of Canada. 2 mos. struct'l designer, 2 mos. asst. to res. engr., and 2 mos. res. engr.; 1921 (Feb.-July), designer, Canadian Mead Morrison Co. on coal handling towers & cable way for Imperial Oil Co. at Sarnia; Not employed at present.

References: C. Luscombe, J. B. D'Aeth. R. P. Raynsford, S. C. Wolfe, H. H. Donnelly, T. C. Connell, E. Brown.

BUCKINGHAM—EDGAR JABEZ, of Winnipeg, Man. Born at Winnipeg, August 17th, 1894; Educ., B.Sc. (C.E.), Univ. of Manitoba, 1920; 1912-13 (summers), on survey parties for city of Winnipeg Engr'g. Dept.; 1914 (summer), inspr., city of Winnipeg Engr'g. Dept.; 1915 (summer), dfting., Good Roads Board, Prov. of Man.; 1916 (summer), asst. to district engr., reclam. branch, P.W.D., Prov. of Man.; 1917, asst. to dist. engr., reclam. branch; 1918, R.A.F.; 1919 (7 mos), Public Utilities Commission of Man., valuation of Winnipeg Electric Street Rly.; 1920, asst. dist. engr., Good Roads Board of Manitoba; 1921, asst. dist. engr., Good Roads Board of Man.

References: M. A. Lyons, H. R. Urie, W. P. Brereton, W. M. Scott, D. Smith, A. L. Cavanagh, J. N. Finlayson, R. W. Moffatt.

COWAN—EDGAR C., of Winnipeg, Man. Born at Thornhill, Man., Jan. 15th, 1894; Educ., B.A.Sc. Univ. of Toronto, 1919; 1915-15 (summers), on surveys; 1915-18, overseas. Can. Engrs.; 1918 (summer), asst. with Murphy & Underwood. Saskatoon, Sask.; 1919 (summer), asst. on ore calculation, Flin Flon Mine, The Pas, Man.; 1919-20, demonstrator in engr'g., Univ. of Manitoba; May 1920 to date, munic, engr. on Good Roads for municipality of Springfield, Man.

References: J. N. Finlayson, E. P. Fetherstonhaugh, R. W. Moffatt, P. Gillespie, M. A. Lyons, W. H. Hunt, J. E. Underwood.

DONNELLY—CHARLES HIBBERT, of Niagara Falls, Ont. Born at Kingston, Ont., Dec. 26th, 1893; Educ., B.A. 1914 B.Sc. (Honours), Queen's Univ., 1919; 1911-14 (summers), Donnelly Salvage & Wrecking Co., Kingston, Ont.; 1914-15 (summers), asst. to supt., Donnelly Salvage & Wrecking Co., Kingston; 1915-19, overseas. Sgt., C.F.A.; 1919-20, design of reinforced concrete bldg., B. H. Prack, Arch't. & Engr., Toronto.; 1920 (Apr.-Aug.), design of reinforced concrete structures, Trussed Concrete Steel Co., Toronto; Aug. 1920 to date, design of temporary structures and cnstrn. equipment, H.E.P.C. (Chippawa-Queenston Devel.).

References: T. S. Scott, R. P. Johnson, W. P. Wilgar, L. L. Gisborne, D. S. Ellis, H. H. Donnelly, J. M. Morton.

DOWLING—HARRY L., of Toronto, Ont. Born at Bolton, Ont., Nov. 30th, 1893; Educ., B.A.Sc., Univ. of Toronto, 1919; 1913 (5 mos), rodman, Detroit, Toledo & Ironton Rld.; 1916 (May-Dec.), asphalt inspr., Detroit & New York; 1918-19, struct'l engr. for Albert Kahn, Arch't., Detroit; 1920-21, struct'l engr., The Solway Process Company, Detroit; At present, struct'l engr., Barber, Wynne-Roberts & Seymour, Toronto.

References: F. Barber, R. O. Wynne-Roberts, H. L. Seymour, W. W. Gunn, J. W. Smith, E. V. Deverall, J. S. Galletly.

FERRIER—ALAN, of Montreal, Que. Born at Ootacamund, British India, May 26th, 1894, Educ., B.Sc. (Civil), McGill Univ., 1920, 1913 (summer), inter work etc., C P R., 1914-19, overseas Capt., Royal Engrs., July 1920 to August 1921, with T. Pringle & Sons Ltd., Engrs., Montreal, as res. engr. and drawing & designing in office; Not employed at present.

References: H. M. MacKay, E. Brown, C. M. McKergow, J. S. Costigan, G. M. Wynn, M. H. Hellbronner.

GAUTHIER—PAUL GILLES, of Montreal, Que. Born at Montreal, March 31st, 1900; Educ., B.Sc. McGill Univ. 1921, 1918-19 (summers), rodman, Quebec Streams Commissions; 1920 (summer), in charge of constrn. of small concrete and rock fill dam for Riordon Co.; 1921 (summer), 4½ months asst. engr. on inspection and estimates roads and bridges for colonization dept. Quebec Govt., At present, demonstrator, McGill University.

References: H. M. MacKay, E. Brown, R. DeL. French, J. Duchastel, A. O Barrette.

LOY—JOHN AUSTIN, of Ottawa, Ont. Born at Valleyfield, Que., May 12th, 1894; Educ., B.Sc. (Civil), McGill Univ., 1921; 1920 (July-Aug.), asst. res. engr., Bathurst Lumber Co.; At present, inspr., Dept. of Public Highways, Ontario.

References: H. M. MacKay, E. Brown, J. B. Macphail, A. M. Phillips, H. C. Kennedy, H. M. Lamb.

LUDGATE—DOUGLAS JOHN, of Pakesley, Ont. Born at Parry Sound, Ont., Nov. 13th, 1893; Educ., B Sc. (C.E.), Queen's Univ., 1912-13, rodman, C N.R.; 1914 (summer), C.N.R., Capreol to Hornepayne; 1915 (summer), in charge of constrn. of private dwellings, Parry Sound; 1916-19, overseas., C.F A. & R.A F.; 1919 (summer), completed course Queen's Univ.; Fall 1919, instr'man., Grasselli Chemical Co., Flower Stn., Ont.; 1920 (Jan.& Feb.), dftsman., Canadian Des Moines Steel Co., Chatham, Ont.; April 1920 to date, res. engr., Schroeder Mills & Timber Co., Pakesley, Ont. and mgr. Key Valley Rly. (Private line).

References: T. S. Scott, W. P. Wilgar, D. S. Ellis, C. H. McDougal, J. B. Harvey, H. S. VanPatter.

MACKAY—LEON FERNAND, of Montreal, Que. Born at Montreal, Nov. 25th, 1893; Educ., B.Sc. and C.E., Laval University, 1915; 1915-16, Canadian Inspection & Testing Laboratories Ltd.; 1916-17, with Bellefeuille & Trepanier, General Contractors, Three Rivers; 1917-18, Imperial Ministry of Munitions; April 1919 to date, divn. engr., Quebec Roads Department.

References: A. Boyer, G. R. Kendall, A. Fraser, A. Amos, E. S. T. Lavigne, B. Rocher.

MACKENZIE—GORDON LESLIE, of Saskatoon, Sask. Born at Guelph, Ont., Feb. 22nd, 1893; Educ., B.Sc. (C.E.), Queen's Univ., 1919; 3 seasons on Dom. Land Surveys previous to University course; 1918 (summer), in charge of survey and constrn. work for Grasselli Chemical Co. of Cleveland at their mining property at Flower Station, Ont.; 2½ mos. in bridge dept., C.P R., Montreal; 6 mos. asst. on D L.S.; May 1920 to date, associated with J. E. Underwood, Consltg. Engr., Saskatoon. Work has been mostly drainage and highway work, partly as res. engr. and partly as consltg. engr., acting in an advisory capacity for the municipalities in Sask. which do not employ their own engineers.

References: J. E. Underwood, R. A. McLellan, A. A. Murphy, K. P. Johnston, J. B. Harvey.

MACLEOD—DONALD KEITH, of Toronto, Ont. Born at Parkhill, Ont., Jan. 4th, 1890; Educ., B.Sc., McGill Univ. 1912; 1907-10 and 1912 (summers), shops, rolling stock dept., Montreal Tramways Company; 1911 (summer), Canadian Westinghouse Co., Hamilton, shops; 1912-20, engr. of equipment and asst. supt., rolling stock, Montreal Tramways Co.; 1920-21, mfg. engr., Ohio Brass Co., Barberton, Ohio, and from Feb. 1921 to date, in charge of install'n. & operation of Canadian Branch of above company, Toronto.

References: L. A. Herdt, C. V. Christie, W. F. Graves, A. M. Lindsay, P. S. Gregory, J. T. Steeves, D. E. Blair.

STILES—RAYMOND DONALD, of Pictou, N.S. Born at Pictou, April 30th, 1893; Educ., B.Sc. Nova Scotia Tech. Coll., 1921; 1915 (summer), mach. shop, manufacture and assembly of rifle sights; 1915-16, 85th Batt., C.E.F.; 1916-17, govt. shell inspr.; 1918 (summer), instr'man, Bate McMahon & Co.; 1920 (summer), repair man, pneumatic tool dept., Eastern Canada Car Co., New Glasgow, N. S.; At present., inspr. for Jackson & Moreland, Boston, Mass., taking inventory of equipment of N.S. Tramways & Power Co., Halifax, N.S.

References: F. R. Faulkner, J. B. Hayes, F. A. Bowman, I. P. MacNab, K. L. Dawson.

WEIR—FRANCIS EDWARD, of Beamsville, Ont. Born at Burford, Ont., March 9th, 1886; Educ., B.A.Sc. Univ. of Toronto., 1915; 6 mos. instr'man., D.P.W. of Can. at Windsor, Ont.; 2 - 6 mos. periods with C.P.R. at Saskatoon & London; 6 mos. at Garson Mine, Mond Nickel & Copper Co.; 8 mos. contracting with brother in Oxford County, in charge of work (ditching contracts); 1916-19, overseas. C.F.A. and R.F.A.; 1½ years to date, asst. engr., Dept. of Public Highways of Ontario, Hamilton-Queenston Highway.

References: W. A. McLean, G. Hogarth, C. L. Fellowes, H. B. R. Craig, P. Gillespie, C. R. Young, G. C. Parker.

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History of the Montreal Aqueduct

Early methods of supply the first aqueduct; first and second enlargements improvements till appointment of Water Board.

A. E. Doucet, M.E.I.C., Chairman, Montreal Water Board.

Paper presented before Montreal Branch, The Engineering Institute of Canada, October 6th, 1921.

Introduction

Since 1856 the water supply for the territory served by the Municipal Water Works System has been taken from the river St. Lawrence. The point of intake was originally about 1½ miles above Lachine Rapids and approximately 3 miles below the outlet of Lake St. Louis but later was moved 1 mile further upstream.

Previous to 1909 this supply was brought from the river to the pumping plants at Point St. Charles through an open canal, generally known as the "Montreal Aqueduct". Since that date, however, the Aqueduct has been in process of enlargement and the water supply has been delivered to the pumps by means of a closed conduit located in the north bank of the canal.

Before dealing with the history of this Aqueduct, brief reference will be made to the earlier systems of supply which it replaced.

First System

At the beginning of the last century, Montreal was a town of about 9000 inhabitants, most of whom resided within the limits of the old fortifications, that is within an area bounded by McGill Street, Fortification Lane, Berri Street and the river St. Lawrence.

The town authorities provided a limited number of public pumps for supplying water to this district, and the remainder of the inhabitants had to depend for their water supply upon water from private wells and cisterns, or upon water from the river and creeks, which latter water was distributed by and sold from carts, much in the same way as is our milk supply at the present time.

The contrast between the service afforded by this primitive system of water supply and that furnished by the present system constitutes a striking illustration of the advance made in water supply engineering during the past century, with incalculable benefit to the health and comfort of the inhabitants.

Second System

In 1800 there was formed the "Company of Proprietors of the Montreal Water Works," which received an exclusive franchise for a term of 50 years and installed a gravity system of supply, the water being obtained from a pond fed by a spring, situated near Cote-des-Neiges and conveyed through wooden pipes to cisterns, located at the corner of Guy and Dorchester Streets, and also on Notre-Dame near Dalhousie Square.

This undertaking, however, was not a success, owing to the unreliability of the source of supply and to frequent breaks in the wooden pipe lines. In 1819, this system, together with the unexpired franchise, was brought out by a new company.

Third System

The new company abandoned the spring at Cote-des-Neiges, and instituted a supply taken from the St. Lawrence river opposite the town and pumped to wooden cisterns, located on Notre Dame Street.

The wooden pipes were replaced by 4 inch iron pipes› which soon proved to be of inadequate capacity. Other difficulties also developed in the system, and the plant was taken over by another company which laid larger mains and installed a more powerful system pumping engine.

By 1843 the system included 14 miles of pipe line, and two pumping engines, with a total capacity of about 93,000 gallons, were in operation.

At about this time the advisability of providing a municipal water works system began to be discussed and led to the purchase of the private plant by the City in 1845 for the sum of 50,000 pounds Sterling.

Municipal Water Works.

Shortly after the water works came under civic control, the suggestion was made that water from the river St. Lawrence could be pumped to a reservoir on the mountain, by means of water power derived from the Lachine Canal, but the idea was considered impracticable.

By 1859, however, the City had made several important improvements to the old system, including extensions to pipe lines and the construction of a 3,000,000 gallon reservoir on what is now St. Louis Square, at an elevation of 130 feet above the river.

The great fire of 1852 destroyed much of the water works system, and was followed by the engagement of Thos. C. Keefer to study the situation and prepare the plans for a new system of water supply.

The scheme recommended by Mr. Keefer and subsequently adopted, provided for the construction of a Canal or Aqueduct from the St. Lawrence River to Point St. Charles for the dual purpose of water supply and development of hydraulic power to operate the pumps.

Original Aqueduct.

The original aqueduct consisted of an open canal which started from the north shore of the river about 1½ miles above the Lachine Rapids and terminated at a structure called the wheel house, situated at the foot of Atwater Avenue.

The canal, 40 feet wide at the water line, 8 feet deep, and 4¾ miles long, delivered water to the wheel house in which were two breast wheels operating a set of 6 pumps with a total capacity of 4,000,000 gallons per day.

The water supply was pumped to a reservoir located at the site of the present McTavish Reservoir through a 24 inch diameter force main.

It is recorded that the canal furnished more than sufficient power to develop 300 horse power, and to raise 5 million Imperial gallons of water, 200 feet above the level of the harbour thus providing a supply of 40 Imperial gallons per capita per diem.

The aqueduct, for a considerable portion of its length, followed the depression formed by two small streams and their branches, crossing them at intervals and therefore interfering with the natural drainage courses.

The provision made to take care of this drainage consisted of longitudinal ditches on each side of the canal and several culvert crossings to convey the water from the north to the south ditch. from whence all drainage entered the original water courses and flowed to the river by gravity.

To provide suitable means of crossing the Aqueduct, substantial masonry bridges were built at main roads and, as traffic along the banks of the canal was not permitted, light farm bridges were built opposite each of the properties divided by the canal.

The only one of these bridges now in existence is the masonry structure which carries the Lasalle Road over the original entrance to the canal, about one-half mile below the Lasalle Bridge.

Although the new system had been well constructed and was capable. under favourable conditions, of supplying approximately twice the quantity of water then required serious difficulties soon arose in operating the canal under winter conditions.

The new system was put in service during 1856, but on account of the blocking up of ice in the canal (or headrace), the formation of frazil, and due to high water in the little River St. Pierre below the wheel house, the water supply was often more or less restricted, and occasionally interrupted altogether, during the winter season when this adverse conditions obtained.

To relieve this power shortage, the channel of the little River St. Pierre was deepened in 1857 and 1858, but not sufficiently to reduce the back water conditions materially. In the winter of 1863 a tail race was excavated from the Wheel House to the St. Lawrence River which greatly improved the situation but by no means relieved the shortage of hydraulic power needed for pumping purposes.

Owing to the growth in population and consequent increase in the demand for water, and on account of the formation of the ice blocks at the entrance to the canal, the supply of water became so uncertain in 1862 and 1863, that the ancient custom of distributing water in puncheons was revived.

By 1866 the situation had become critical, and the authorities concluded that the only feasable remedy for such water famines would be to supplement the hydraulically operated pumps by steam pumps, and in 1868 the first steam driven pumping unit was installed in a new building adjacent to the Wheel House.

Additional steam pumps were added as required to meet the ever increasing demand for water, and in course of years the plant virtually became a steam operated station supplemented by hydraulic pumping units.

Projects For An Improved Water Supply

About 1870 the situation was again critical, and several different projects for securing a reliable and adequat supply of water for the City were proposed and studied by various engineers.

Among the schemes considered at that time were the following:—

1.—The securing of additional power by means of an hydraulic development at the Lachine Rapids.

2.—The installation of a gravity system of water supply from the Laurentian mountains.

3.—The construction of a covered aqueduct, parallel to the existing canal.

4.—The construction of cribs, along the river for a distance of about two miles above the entrance to the existing canal, in order to secure 3 feet additional depth of water in the canal, with increase in capacity.

The scheme finally adopted was that proposed by Superintendent Louis Lesage, and provided for the construction of a new entrance to the canal, from a point about 3,000 feet upstream from the old entrance, and in the enlargement of the original canal, throughout its entire length, to an average width of 100 feet and a depth of 14 feet. The enlarged aqueduct was to provide sufficient hydraulic power for a water supply of 30 million Imperial gallons per day.

Construction of New Entrance

Work on this project was started in 1877, but after the new entrance had been built and the upper section of the enlarged canal had been completed from this point eastward to a junction with the original canal near station 220, operations were discontinued and the central and lower sections of the original aqueduct not disturbed.

This new upper section was 78 feet wide at the bottom, 130 feet wide at the normal water line, and 14 feet deep. The sides were excavated at a 2-1 slope and protected at the water line by a continuous layer of rip rap, as is customary in canal work.

The change in the location of the point of intake, together with the construction of the upper section, resulted in a distinct improvement in the water supply situation, but even this was not of long duration. As the years went on, the ever increasing rate of consumption made it necessary to enlarge the steam pumping plant and led to the discussion and study of various other means for increasing the quantity and improving the quality of water supply.

Project of 1905

The troubles in regard to the water supply led Chief Engineer Geo. Janin, early in 1904, to outline a plan for the remodelling of the entire Aqueduct system, and on November 22-1905, he recommended a scheme now generally known as the "First Enlargement of the Aqueduct."

First Enlargement of Aqueduct

The essential features of this scheme may be stated as follows:—

1.—The enlargement of the middle and lower sections of the original canal to the dimensions of the upper section built in 1878, together with the deepening of that section, so as "to furnish a maximum of 5,000 horse power and to assure at all times of low water and ice conditions the 2,000 effective horse power needed to pump 50 million gallons per day".

2.—The remodelling and increase of hydraulic power and pumping equipment to a capacity of 50 million gallons per day.

3.—The enlargement of the tail race, below the wheel house, to the capacity necessary to discharge the water from the enlarged canal or headrace.

4.—The construction of the reinforced concrete conduit along the north side of the canal, from the pumping station to the St. Lawrence River, just above the entrance to the aqueduct; also the provision of the two intakes from this conduit, one located near the shore, the other in the main channel of the river, some 1,200 feet from the shore.

This primary object of this conduit was to convey the water supply from the St. Lawrence to the pumping station during the period when the canal would be out of service for enlargement, but it also served to eliminate opportunities for the pollution of the water supply en route to the pumps.

The purpose of the outer or river intake was to secure St. Lawrence River water unmixed with shore water and water from the Ottawa River, with consequent improvement in the quality of the supply.

Lateral Conduit

After considerable discussion, it was decided in 1907 to proceed with the project, substantially as outlined above, and a contract for the construction of the new supply conduit was awarded that fall and completed two years later.

Decision as to the construction of the river intake was deferred until 1910, and it was not until the Fall of 1913 that this portion of the conduit supply system was ready for operation.

Contract No. 1.

In the summer of 1910 Contract No. 1 for the enlargement of the canal wasawarded to Quinlan and Robertson Ltd. This contract included the construction of the temporary dam at the entrance, the unwatering of the entire canal, the deepening of the upper section, and the widening and deepening of the original canal from the lower end of that section (near Sta. 220) to the Wheel House; but it did not include the enlargement of the tail race, the reconstruction and extension of the hydraulic pumping ement, or certain other essential parts of the project, all of which were to be carried out under other and subsequent contracts

The enlarged canal was to have had a width of 60 feet at the bottom, 123.5 feet at the flow line and a depth of 17 feet. The sides were to be excavated at a slope of 2.1. and protected at the flow line by stone paving.

Report on an Improved Water Supply

In April 1910, Messrs. Hering & Fuller, consulting Engineers, were engaged to investigate "The best means of securing and improved water supply for the City of Montreal".

Their report, dated July 2-1910, dealt not only with "the development of the present supply from the St. Lawrence River, but also questions of other sources of supply such as artesian water and a gravity supply from mountain lakes".

Space does not permit discussion of that report, but it is important to record that they endorsed the project for the "First Enlargement" of the aqueduct, and recommended the construction of the river intake, and the filtration of the water supply also that it was conclusively shown these measures" would give an improved supply of quality as satisfactory as a filtered gravity supply from the Laurentian Mountains and at very much less cost".

Project of November 2, 1910

In November 1910, about six months after work under Contract No. 1 had been started, a more ambitious hydraulic power project, known as the "Second Enlargement" of the aqueduct was proposed by Mr. Janin, and adopted by the City.

Second Enlargement of Aqueduct

The object of this project was "to produce a minimum of 10,000 horse power at all times, that is to say 7,000 horse power more than contemplated by the original scheme" of which 6,000 horse power would be available for pumping 100 million gallons of water per day, and 4,000 horse power for other municipal needs, such as lighting the streets and public buildings.

In order to secure this power, it was proposed to widen the canal at the water line to 174 feet and to increase the cross sectional area of both the canal and the tail race by constructing concrete retaining walls instead of sloped banks on each side thereof.

In connection with this enlargement, it was proposed to make the banks along both sides of the canal of such width that they could later be utilized as boulevards.

Following the adoption of the new project in November 1910, further work under Contract No. 1 was confined to that portion of the canal between Sta. 220 and the wheel house, and instead of sloping the sides of the canal, the contractors for the First Enlargement were permitted to remove an equivalent quantity of excavation at a steeper slope, in preparation for the further widening of the canal prisms; and in view of the substitution of concrete walls for sloped sides, the requirements as to water-tightness of the embankments were not enforced. In the fall of 1912 Contract No. 1 was cancelled and preparations made to proceed with the Second Enlargement.

Contract No. 2.

In June 1913 Contract No. 2 for the earthwork and concrete structures in connection with the new project was awarded to the Cook Construction Co.

This contract included the construction of a temporary dam at the entrance, the complete unwatering of the aqueduct, the enlargement of the canal, forebay and tail race, the construction of concrete retaining walls and of earth embankments along both sides of the aqueduct and of boulevard embankments along each side of the canal from Church Street to Lasalle Road, also culverts, drainage ditches and other miscellaneous items of the work.

Contract No. 2 did not, however, include certain improvements at the entrance, the head gates, the bridges, the hydraulic power and pumping station and other essential features of the new project, all of which were to be constructed under separate and later contract.

Conduit Break

In carrying out the work under Contract No. 2, the Cook Co. employed drag-line excavators, which weighed 120 tons and were operated from the top of the canal bank. One of these machines, in working eastward along the North bank, excavated so close, to the conduit, than an earth-slide occurred at a point about 100 feet east of the Asylum Bridge and partly exposed the side of the conduit. Efforts were made to stop the leakage and restore the lateral support, but without success, and on Christmas Day 1913 the conduit broke at sta. 124, with the result that the City's water supply was interrupted for a period of ten days.

Messrs. Jamieson, Lea, and Heckle were engaged to study and report upon the cause of the accident to the conduit and other matters arising therefrom. One of the recommendations made in their report was that "an investigation be made by a commission of engineers into the entire aqueduct scheme, which would include revised estimates of the cost of the construction and the quantity and the cost of the power developed." This, however, was not done at that time.

Emergency Supply System

Following the accident to the conduit, it was decided early in January 1914 to make a connection between the Lachine Canal and the low level pumping station, as an alternative source of water supply in case of another break in the lateral conduit, which might again expose the City to the danger of a conflagration.

There was accordingly installed the so called "Emergency Supply System", which consists of a large steel pipe line from the canal to the suction well at the lower end of the lateral conduit, together with a low lift electrically operated pumping plant adjacent to that well. This system enables water from the Lachine Canal to be delivered to the suction well, and thence to the low level pumping station, in case the normal supply through the lateral conduit be interrupted for any reason.

Report of June 16, 1915

A report to the Board of Commissioners, dated June 16, 1915, by the deputy chief engineer, recommended that certain modifications be made in the original design of the retaining walls, which would considerably increase the cost of that particular part of the work. The report also outlined the other works needed to complete the project for the second enlargement - the more important of which were:

(1) The extension of the guard pier at the entrance to the aqueduct in an upstream direction, for the purpose of increasing the depth of water in the canal and decreasing the formation of frazil ice.

(2) The deepening of the approach channel between this pier and the shore line;

(3) The installation of head gates at the entrance to the aqueduct to control and regulate the flow of water into the canal;

(4) The construction of eleven bridges across the enlarged aqueduct at certain specified points;

(5) The construction of an hydraulic-electric power and pumping station at the site of the old wheel house, adjacent to the low level pumping station and the filtration works.

In accordance with this programme, modifications were made in the retaining walls to be constructed under Contract No. 2; the Church bridge and the Bond Street retaining wall were built under Contract No. 4, and the work on lasalle bridge and head gates begun under Contract No. 3.

In the meantime, the Council of the Canadian Society of Civil Engineers, and at a later date the Committee of rate-paying engineers, requested that a commission be appointed to investigate the whole project.

Report by Board of Engineers

In April 1917 the City appointed a Board of Engineers consisting of Messrs. Vautelet, St. Laurent and McRae to study and report upon the proposed hydraulic developement and other matters in connection with the second enlargement project.

The members of the Board investigated five separate schemes for the completion of the aqueduct, but were unable to agree upon a recommendation as to which of the said schemes should be adopted.

They were unanimous in advising that Contract No. 2 with the Cook Construction Co. be cancelled, and in December 1917 this was done and the various issues between the parties were referred to three Arbitrators for settlement.

Although the limits of this paper prevent detailed consideration of the schemes outlined in the several reports submitted by the members of the Board of Engineers in 1917, mention should be made of the following:—

Scheme No. 2

Contemplated radical changes in the previous plans for the work it provided for the completion and utilization of the aqueduct for the dual service of water supply and power development, and included the provision of a steam auxiliary electric power station to insure a continuous supply of power during the winter season, when the operation of the hydro-electric station would be affected or suspended on account of frazil and ice troubles; also the construction of an electric operated pumping station.

Scheme No. 5

On the other hand, provided for the completion and utilization of the canal section of the aqueduct primarily for the purpose of water supply; the construction of an electric operated pumping station, and the purchase of the electric power required to operate this new station and the filtration works.

Although no definite course of action was decided upon at this period, the City continued with the construction of Lasalle bridge and also built the remaining permanent concrete culvert crossings needed for drainage purposes.

Some time later Messrs R. S. Lea, M.E.I.C., and W. S. Lea, M.E.I.C., consulting engineers, were engaged by the City to consider the entire situation and recommend the best method to be adopted for the completion of the Aqueduct.

Lea Report

Under date of December 31, 1919, Messrs. Lea submitted an exhaustive report, which reviewed previous investigations and described three main projects for the completion of the Aqueduct work; namely—

Project No. 1—Water supply only.

Project No. 2—Medium power.

Project No. 3—Large power; in which developments steam auxiliary power stations were provided to insure a continuous supply of power under all conditions.

The investigations recorded in this report clearly demonstrated that it would not be an economical proposition to complete the aqueduct for power purposes.

The principal recommendations made with this respect to the aqueduct, and associated work may be summarized as follows:—

(1) That the aqueduct be completed for water supply purposes, as outlined under Project No. 1.

(2) That a new motor-driven pumping station be constructed, and operated on electrical power purchased from the Montreal Light Heat and Power Consolidated, under specified conditions; and that the equipment in the present steam plant be eventually disposed of.

(3) That the rated capacity of the filtration works be increased to approximately 120 million gallons per day.

(4) That additional elevated reservoir storage be installed in connection with each system, to provide for 8 hours standby storage, over and above the capacity required for equalizing purposes.

The Montreal Water Board

The Administrative Commission, by resolution of May 3rd, 1920, constituted a board of three engineers, known as the Montreal Water Board, to study and carry out improvements to the Water Works System. Under the directions of the said Board, the aqueduct is now being completed substantially in accordance with Project No. 1 for water supply only, but with much modifications therein as further investigations have shown to be desirable.

Note:— In the compilation of this paper the writer has made use of the following documents, and wishes to acknowledge his indebtedness to the authors thereof.

The Montreal Water Works—History from 1800 to 1912, by F. Clifford Smith, published April 1913.

Repart on an Improved Water Supply for the City of Montreal, by Herring & Fuller, consulting engineers, dated July 2, 1910.

Report on Montreal Aqueduct, by R. S. & W. S. Lea, consulting engineers, dated December 31, 1919.

Engineering Theory and Practice at the End of the Seventeenth Century.

Mechanics of materials engineering design and contracting methods as practised in France in the reign of Louis XIV.

D. S. Ellis, A.M.E.I.C.

Paper presented before the Kingston Branch, The Engineering Institute of Canada, April 12th, 1921.

Introductory

A few years ago there came into the writer's possession a quaint old book entitled "La Science des Ingénieurs dans la Conduite des Travaux de Fortification et d'Architecture Civile", published at Paris in 1739, "avec approbation et privilège du Roi". It interested at first because the flyleaf bore the signature of a great British general of a century ago,—Charles Napier. Then arose an even stronger interest on account of the contents themselves, being written in 1728 by Belidor, professor of mathematics in the Royal Artillery School at Paris, and setting forth the principles of engineering construction employed by de Vauban the great engineer of Louis XIV, as well as Belidor's own attempts to evolve a rational theory of engineering design. This old book which is of "family Bible" proportions contains within its covers the principles and practice of engineering, current in 1700 and may be fairly said to be the "hand book" of that time. It may interest others to know how the engineer of two centuries ago considered and solved the problems of design and construction which confronted him, and the following brief account deals with some of the more interesting topics dealt with in the text.

The subject matter is methodically arranged and deals with all matters relative to engineering construction, from theorems in elementary statics, to discussion of materials and the drawing up of specifications, and letting of contracts. Even the modern subject of town planning is not neglected for the lay-out of a fortress town is fully dealt with. He also discusses paving and sanitary arrangements. Specifications are thoroughly discussed, and an example is given of those de Vauban drew up for the old barracks at Bethune.

In attempting to describe in detail some of the subjects which are considered in the text they have been grouped as follows,—mechanics of materials, materials of construction, foundations, costs, specifications and contracts.

Before proceeding at once with the subject of this paper it might be helpful to recall the state of affairs scientific as well as political at the time with which we are to deal. Newton was then at Cambridge and had a short time before given to the world his Principia. The controversy between Leibnitz and Newton as to the discovery of the calculus was still being waged. Hooke had some fifteen years before announced his law of elasticity which is now the basis of design of structures. Chemistry was an unknown science, as were geology and its kindred studies. Louis XIV was nearing the end of his long reign, and was waging war against Marlborough and Eugene. In Canada the great Frontenac had just passed away and Kingston which then bore his name was a stockade fort and trading post and had been founded some thirty years before.

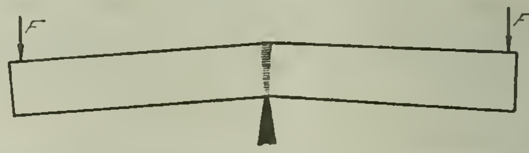
Mechanics of Material and Engineering Design

Such terms as "the mechanics of materials" and "rational design" of course do not occur in the text, but the ideas are there, and to examine them more easily they are grouped in the present day manner. Judging from the author's remarks, engineering previous to his time was altogether a matter of established rule and precedent. Belidor is very antagonistic to such methods, and proposes to apply the principles of statics in the design of structures. "Otherwise" he says" the structure will either fail or if it stands will have a useless excess of material". He does not spare his criticism of the rule of thumb designer and the unqualified engineer and architect.

Beams of Timber

Since timber beams enter so largely into all buildings and fortifications he considers that they should be properly and carefully designed. Before Belidor's time the only work dealing with timber or other beams in a scientific manner, is a report to the French Academy in 1702 by a M. Parent. This, Belidor considers to be too abstruse for his readers, so he proceeds to develop the theory in his own way and to illustrate its applications.

Fig 1 Conception of Flexure.



The actual bending of a beam is the same whether it is in a building or bent across a fulcrum as in fig. 1. Hence the examination of the beam in fig. 1, will furnish the secret of the resistance of a beam, which may be applied to those in a structure.

The forces at the ends of the beam exert a moment which is resisted by the series of small moments due to the tension in the fibres of the wood and which have arms equal to the distances of the particular fibres from the point of application of the fulcrum. Considering the sum of these he concludes that the resisting power of a beam of given cross section is proportional to the product of the depth by one third of the area of the section. This is twice the quantity which we call the section modulus; so he has discovered the relation which we use to-day. It is also interesting to note that he assumes all the fibres to be in tension, and that he does not consider either that there is any compression or line of "no stress".

The effect of the length of a simple beam is stated in his complete law for beams viz.—that the resisting power of a beam for a single load at the centre varies inversely as the length and directly as the product of the depth by one third of the area. For the same load he sees that cantilever beams are more highly stressed since the arm of the applied force is longer.

It is on restrained beams that he lays most importance since they are the kind most used in the structures with which he deals. By a combination of theory with experiment, he deduces that, since the beam is bent in three places instead of only one as in the case of a simple beam, it will not be as severely stressed at any one point. Hence it will take a heavier load to break such a beam.

Experiments on the Strength of Wooden Beams

To confirm and probably to guide and develop his theories, Belidor conducted several series of experiments upon oak beams. These are the first tests of the kind of which we have any record. In each case the beam was loaded to failure by a weight placed at the centre. His results are interesting not only from their uniform character but also from the fair manner in which they are reported. The theoretical results are of course confirmed, and in the case of the restrained beam the wieght carried is double that for a simple beam. From this he concludes that every care should be taken to see that the ends of such beams are well tied down, so that the full benefit from the restraint may be secured.

He does not attempt to figure out fibre stresses nor does he deal with anything like factor of safety. The beam is the only timber detail considered, since columns of any structural importance were of masonry.

While deep in the discussion of the effect of depth upon the strength of a beam, he turns aside to mention the current practice of selling timber squared, and in lots of one hundred pieces. He explains that the square section is not the best for a beam, and gives a geometrical method of solving the problem in "maximum", due he states, to M. Parent viz.—to cut the strongest beam from a round timber of given diameter. This is the origin of the stock problem which has probably been given ever since by teachers of "applied mathematics."

Masonry Structures

The only medium possible for structures of any size at the time with which we are dealing was masonry. Its importance to the engineers of that day is shown by the thorough treatment accorded it by the author.

But before the actual design of walls or other structures is taken up, he develops certain fundamental theorems on forces and moments which are essential to his argument. He is very earnest in his desire to apply sound methods and to have no truck nor traffic with guess work.

Retaining Walls

In his development of the design of walls he starts with the following three assumptions,—

1. The wall is on an unyielding foundation;
2. The masonry acts as a monolith;
3. The area of the profile of the wall may for purposes of design be considered to express the weight of a unit length of the wall.

At this stage there is no attempt to analyze or determine earth pressures, for he simply designs a wall section to resist by its weight the overturning effect of an assumed force acting at right angles to the length from the top of the wall. The method employed is that of equating the turning and resisting moments about the toe of the wall.

If the overturning force at the top of the wall be represented as equal to the weight of "b.f." cubic feet of masonry, and the height of the wall be called "a", he finds that the width required for the stability of a wall of rectangular section is $\sqrt{2bf}$ ft. If the wall is of the same height, but has a batter on the outer face of 5/1 then if $d = a/5$, the width at the top is given by $\sqrt{2bf+\frac{d^2}{3}} - d$.

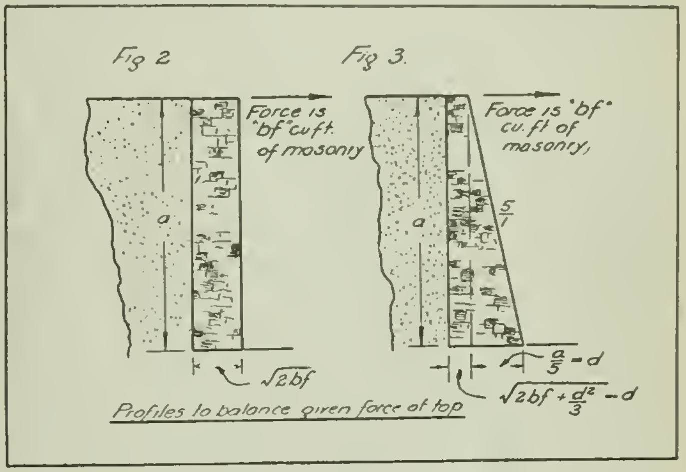


Fig 2
Fig 3.
Force is "bf" cu ft. of masonry
Force is "bf" cu. ft of masonry,
a
a
5/1
$\sqrt{2bf}$
$\frac{a}{5} = d$
$\sqrt{2bf+\frac{d^2}{3}} - d$

Profiles to balance given force at top

Besides the two simple types of wall mentioned, there is quite a complete discussion of the design of the counterforted wall. However these two suffice to show the methods employed in this early attempt in rational design of structures.

Earth Pressure Against Retaining Walls

The physical basis of Belidor's theory of earth pressure is the observed fact that when earth slides it moves along a plane which is approximately 45° with the horizontal. This angle, he notes, varies somewhat in different soils and conditions but he considers that 45° is a good average value. From this he argues that if there were no cohesion in the soil itself the pressure which would be exerted against a vertical wall as in fig. 4. would be equal to the weight of a prism of earth of the length of the wall and a 45° triangle in section. However to allow for the effect of internal friction he arbitrarily reduces the pressure to one half of this amount. In computing the effect of pressure against a wall of given height he seeks to reduce it to an equivalent weight of masonry acting horizontally at the top of the wall. To do this the first step is to divide the wall vertically into a number of equal parts as at each foot. From each of the points so found lines are drawn at 45° as shown in the fig. 5. If the pressure of the small triangle at the top be considered as equal to a force "b" acting at the top of the wall, then the pressure of the trapzoid next below would be "3b" acting one foot from the top, the next trapezoid would be "5b" acting two feet from the top and so on. Taking the moments of each of these forces about the foot of the wall, the total overturning moment on the wall is $b\times10+3b\times9+5b\times8+\ldots+19b\times1=385b$. "b" is determined by considering the small triangle at the top. Its area is $\frac{1}{2}$ square foot, and allowing for cohesion the force it exerts on the wall, is by Belidor's theory, equal to the weight of $\frac{1}{4}$ cu. ft. of earth, or $\frac{1}{6}$ cu. ft. of masonry. Hence taking "b" as $\frac{1}{6}$ cu. ft. the total overturning effect of the earth pressure, where unit of force is the weight of one cubic foot of masonry is a moment of $385\times\frac{1}{6}$ cu. ft.—ft. The horizontal force at the top which produces the same moment is equal to the weight of 6.42 cu. ft. of masonry. This is the "bf" used in the design of walls. In actually working out the thickness of a wall he uses a factor of safety in that the theoretic value of "bf" is increased by $\frac{1}{4}$. So that in the case of a 10 ft. wall as we have just been considering the thickness for a rectangular section is $\sqrt{5/4\times2\times6.42}=4.00$ ft. If a batter of 5:1 is used on the outer face the thickness at the top of the wall should be $\sqrt{5/4\times2\times6.42}+\sqrt{4/3}-2.00=2.17$ ft.

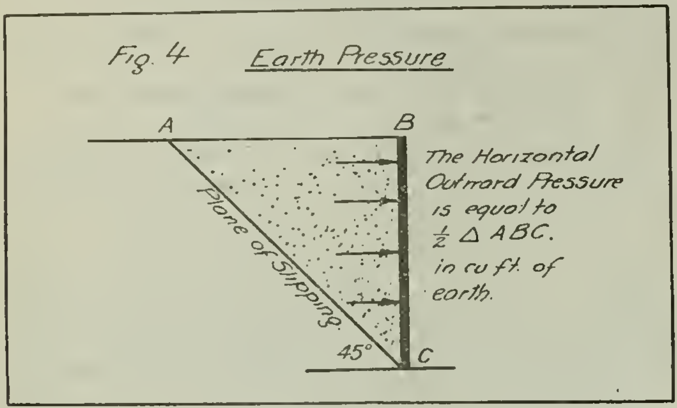


Fig. 4 Earth Pressure
A
B
C
Plane of Slipping
45°
The Horizontal Outward Pressure is equal to ½ Δ ABC. in cu ft. of earth.

It is interesting to note that the point of application of the resultant earth pressure works out as a point 3.85 feet above the base. Using this value and the mass of the profile of the wall in Fig. 3, the resultant of the two falls just inside the toe of the wall. This is to be expected since he finds the section of wall which will just balance the earth pressure plus one quarter.

As a continuation of this work he investigates the dimensions for surcharged walls, and then takes up counterforted walls.

For all these types complete tables of dimensions are given with the height as argument, and arranged for different kinds of loading.

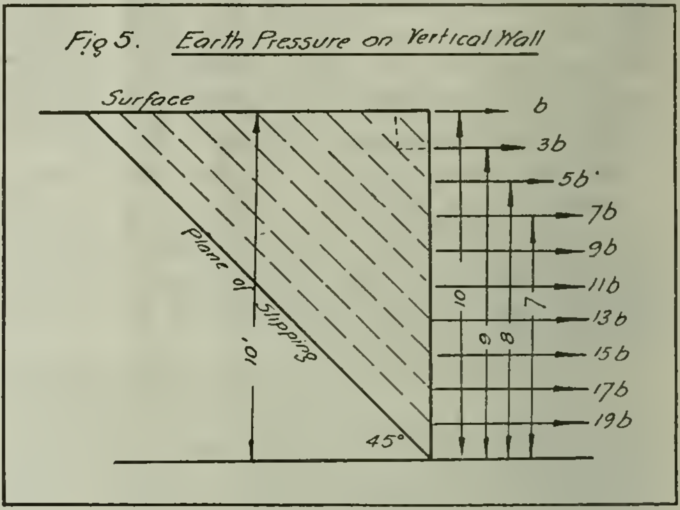


Fig 5. Earth Pressure on Vertical Wall

Materials of Construction

The author realizes that not only must he know the stresses which occur but also the properties of the materials to be used in a building. So he takes up thoroughly all the structural materials then in use, dwelling especially upon those that enter into masonry work. In considering his presentation of the subject we must remember that testing machines were not then in use, and that chemical analysis was unthought of.

Woods

Under the heading "The Quality of Woods to be used in Carpentry" we find an interesting discussion of this material. In part he says,—"Of all woods the oak is the best for permanent structures, being very hard and strong. If used under water the effect of the water is to harden it so that tools will hardly cut it, as may be seen in the case of the old Roman piles.

Chestnut was once highly favoured but it is found to check easily and rots when on a masonry seat.

Elm is suitable where a flexible and pliant wood is required but is too scarce and expensive for general use.

Fir, either ordinary or red, is used for stringers and planks in floors and also for sheet piling in locks. It has however a tendency to heat and become wormy in buildings."

As a general guide he states that timber partakes of the nature of the ground on which it is grown; e.g. if the ground is moist and rich the wood will be softer than if it were grown upon high dry ground. The reason assigned for this phenomena is the extra growth of sapwood under the bark. It is recommended that timber be cut at maturity and be seasoned for at least two years before being placed in work. To ascertain the condition of timber which is already cut he gives the following field test,—sprinkle a little hot olive oil upon the ends of the stick when one of the following reactions will be observed and the corresponding deduction made:—

a. The oil cracks and spatters, — the timber comes from a marshy country and the sap is acid.

b. The oil is not absorbed, — the timber was grown in a dry country but was cut with the sap in it.

c. The oil is absorbed, — the timber was grown in dry country and was cut in the winter.

Evidently the study of entomology was not very wide in those days as the following discussion of worms in timber will show. "Some clever people pretend that the worms found in the wood do not come from the substance of the wood itself, but that they are introduced into the pores by the sap. These hatch out after a time and produce the worms found there when the tree dies.—Other people maintain that a fly bites the bark and lays its eggs there."

To avoid what he calls heating in timber beams on masonry seats, he recommends that the ends of the beams be left open to the air by leaving holes in the walls. However this seems to be a private theory of Belidor which he got up on the spur of the moment.

Iron

Apparently wrought iron was the kind most in use in structures of that time, probably for hinges, gates, etc. So we find his discussion of this material to be governed largely by the action of the metal under the hammer and the file. He gives an interesting catalogue of the irons mined in the different localities in France and also in Sweden and Spain. First place in regard to excellence is awarded to the iron from the Berry district in France. Spanish iron he claims was so soft that it could be forged cold.

Stone

Economic geology seemingly was not highly developed at any rate in regard to building stones, for in classifying them Belidor uses the two great divisions of hard and soft. The former is of course, the superior, due to its frost resisting qualities. This resistance is explained by the hard stone not being so porous, and so, absorbing less water. "For" he explains" it is the expansion of the water when ice is formed which causes the stone to crack and flake off in the winter."

Following quite a clear and sound discussion of the effect of frost upon stone we come upon the following quaint theory, which the author does not wholly endorse, yet fears to reject altogether. "It is not only frost which destroys stones, for they believe that the moon changes them. This can be explained by the power of the moonlight to dissolve loose particles of certain stones. In this case one must conclude that the rays are moist and entering the pores of the stone cause the particles to separate and the stone to appear powdered. However one can make of this what he will, but it amuses me to think that if the moon attacks or wears away the stones of the earth, the latter which must act as a great big moon, must have a great revenge and the stones up there can't have much of a time of it."

The following instructions to be followed in selecting a stone for any job, show that while some peculiar ideas may have been held in regard to the lunar influence, yet on the whole the main issue was not seriously misunderstood. He says first, to examine all old buildings in the vicinity to see how they have stood up. Then if circumstances permit test fragments of the stone itself by leaving them out in the wet and frost all through the winter. The colour is also important, for that which is of a deep yellow colour should be viewed with distrust, till it passes the frost test. The texture should be firm, and the stone free from yellow or brown veins, and it should not contain shaley material.

Brick

To obtain good brick the importance of the right quality of clay is recognized. It should be free from gravel and be grey or whitish in color. As a test for its suitability he recommends as good for brick that which when one walks across a field of it after a rain, sticks to the shoes in ever increasing quantities and is difficult to remove.

The method of manufacture from the selection of the bed of clay to the final burning is quite fully described.

Good brick should have a good colour and when two are struck together they should ring clearly. The conclusive test for brick as for stone is the frost test, of leaving several bricks which are fair samples, out all winter in the wet.

Lime, Sand and Mortar

These three materials are treated fully and carefully and there is really not much difference between the discussions given by Belidor and those which occur in the books of to-day. Though of course there are a few theories which are interesting because they are indicative of his desire to explain things rationally. He thinks that the durability of mortar depends upon the presence in it of certain salts, which in the course of time evaporate and leave the mortar a non-cohesive mass. This idea is gone into at some length. Another point of interest is his theory that in order to get the best bond between stone and mortar, the lime in the latter should be burned from the same rock which is to be used in the wall itself. In this opinion he quotes Philbert de Lorme one of the architects of that time as concurring.

Besides ordinary mortar as we know it he describes varieties of limes which seem more akin to hydraulic cement, one of these called the "cendrée de Tournay" is made from rock at that place.

While the examples given have been necessarily very brief and perhaps the quaint side has been unduly dwelt upon, yet we can conclude that the engineers of the period we are discussing understood the importance of sound materials and as far as their science went, they treated them in a sound and scientific manner.

Foundations

From Belidor's discussion of foundations we are enabled to a glimpse of the manner in which these old time engineers regarded the same problems which come up for solution today. For while our more advanced methods of computation and the results of our analysis of materials give us an immense advantage in regard to superstructures yet when we begin to consider foundations we are not so much better off than they were. So in this way a truer comparison of the methods and point of view in general, can be gained. Since foundation work has progressed less by theory than by hard experience, it is not surprising to find that two hundred years ago thoroughly sound methods were in vogue in this class of work. In fact we can go back much farther still, for Vitruvius in his treatise on architecture written about the time of Augustus Caesar, gives a very sound treatment of most of the methods which are in use today in foundations.

For foundations upon good rock he recommends chipping either a level or a stepped bed, and starting the masonry from that. Where the rock is very irregular he gives as a very satisfactory method the erecting of forms the interiors of which are filled with small boulders, and the whole grouted solid with a thin mortar preferably of the "cendrée de Tournay" mentioned above. In the case of ordinary earth a foundation course of broad flat stones should be laid and the crevices filled with spalls and mortar and the first course laid on it.

Before dealing with foundations as such, the author describes the various types of ground which are encountered in sinking foundations, and these he classifies as,—rock or tufa, sand either firm or moving, and soil such as loam, clay, turf or peat. The characteristics of each kind of ground are discussed and then he deals with the type of foundation which is best adapted to each.

Where good footing is at a depth, and it is not desired to carry the wall down to that, pillars should be built to it, and the rest of the wall borne upon a row of arches which bridge the gaps between the pillars.

In sinking foundations to any depth, ground water is of course a problem, and he is very clear that the best way to handle springs is to incorporate in the masonry tiles or drains which will carry the water from each spring to a common sump whence it may be pumped. Attempting to smother the flow by throwing in lime and ashes he states to be futile. He also deprecates the method advocated by some, of finding the hole whence the spring issues, and then pouring quicksilver down it to keep the water back. One wonders who was the inventor of this method.

Where the ground is very soft and the weight not too heavy he recommends carrying the foundation on a timber grillage. And where possible he is in favour of consolidating the ground by driving piles in the centre of the spaces in the grillage. If the ground will not carry the grillage by this method piles must be driven to carry it and to consolidate the ground.

Some of our terms now used seem to have come from this period or perhaps earlier, for we find the exact French words for "driving to refusal". The hammer is called "un mouton". A curious type of sheet piling not dissimilar to the Wakefield is described and is formed by driving round sticks with slots in the sides on about 15 inch centres and filling the gap between them by then driving plank in the slots.

In the case of quicksand or boiling sand as he calls it it is often possible to put the foundation course directly upon it if care is taken that no excavation in the vicinity drains off the water. This method he says has been successful at Arras, Béthune, Tournay and Lille.

Cofferdams or "coffres" are considered and explained. Where an underwater foundation is to be built upon bad bottom he recommends putting in first a good rock fill and placing the cofferdam on that.

In dealing with foundations there is no attempt made to arrive at quantitative results in regard to the bearing power of soils or of piles; though it is altogether likely that there were certain recognized practices among the architects and engineers of the time as to what was necessary in a given case.

Costs

Perhaps there are many who believe that the ideas of cost analysis, unit costs, etc., are quite modern. Belidor however gives de Vauban's practice in these and it is interesting to see the detail with which things are analyzed. Before going into this however it might be well to explain that the work on fortifications, etc., was all contract work and the engineer had to understand costs thoroughly to pass upon the bids of the contractors.

In estimating the cost of materials every item seems to be considered. For instance in the case of lime, the engineer in estimating the cost, should analyze it so as to allow for the cost of getting out the rock, hauling to the kiln, the coal and cost of burning, drawing the charge, hauling to the work. To reduce this to a unit cost against the cubic toise of masonry (8 yds) he states that, in round numbers, 12 quintals or hundred-weight of lime are used per cubic toise of masonry. Similarly all the other items are considered in the same detail, but into these it is not necessary to enter.

Another important item on the work is the cost of transporting the materials to the job. To figure this out he gives a table of weights per cubic foot of various materials and states that a three horsed wagon can draw about 1500 pounds. If a canal has to be built, its cost should be charged against the materials carried on it.

One figure he gives in regard to a mason's work is, that in massive work a good mason should place two-thirds of a toise of masonry per day, in a wall two feet thick he should do a square toise.

Engineers and Contractors

De Vauban's advice in regard to the awarding of contracts and the relations between engineers and the contractors gives one an idea of the type of man that he was. His ideas are contained in extract translated below.

> "Fortifications are ordinarily executed by general contract, by special contract, or by statute labor, or usually by all three methods in combination.
>
> When one can find contractors, solvent and who have the capacity to handle a general contract it is best to deal with them. But it is rare indeed to find heads steady enough to carry a burden as heavy as a general contract. For the speed which is generally made on such work and the duration of the thing brings the contractor to a state that he doesn't know where he is. So it is often better to stick to special contracts.
>
> It should also be noted that in work of any magnitude, when passing on the prices it is well to go through all the forms but not always to award it to the lowest bidder. For it is necessary not only to see if the contractors have the means to carry on financially, but also if

they have the intelligence to carry out the contract. They must be granted reasonable conditions, without beating their bids down to the last notch. For if the contract is a bit difficult and is given to poor folk, or ignorant, they will take it at any price they can get, hoping to make a profit in some way or other. But not only do they not find it when they come to try the work, but one must wait till they get what profit they can out of it while they throw the whole thing in confusion. Then losing their heads they fall flat and give up everything if not prevented. If this, unfortunately, happens, the work dawdles or moves with exasperating slowness, everything is in confusion, prices are ruined, and the new contractors who must be called in, will only take the work at an exorbitant figure.—All this causes infinite trouble for the engineer, who gets things going again, only with the greatest difficulty, and concludes that there is nothing so pernicious as false economy.

Methods of Calling for Bids and Awarding Contracts

The procedure in detail of tendering on such contracts, as were let for military or other public work, is given as nearly as possible in the words of the text.

"Of the Forme of the Award, the Formalities observed in Making it, and the Way it is Granted."

> "The specifications being drawn up and part of the funds available the Intendant of the Province causes to be published and posted in all parts of his department and even in the neighboring provinces, word that on a certain day he will be at his mansion prepared to deal with the awarding of work for the construction of the new place, to which all will be admitted who wish to take part in the contract. In order that the King may receive the best results this notice is given.
>
> On the given day the Intendant, accompanied by the Director of Fortifications and in the presence of those there assembled, has read, in a loud voice, the whole specifications, so that those wishing to bid may be informed of the nature and extent of the whole work, and the conditions pertaining to it. After this the bids are called for from the different contractors, for each kind of work. When the lowest bid seems to have been given, three wax papers are lighted in succession, during which time a new and lower bid may be given by another contractor. If none is received in this interval the contract is awarded to him who has given the best bargain to the King; and they prepare then an agreement in the following terms."

Then follows a detailed account of what the contractor has agreed to do, what he is expected to furnish, and what rights and privileges are granted to him whether in peace or war.

This whole section of the book is full of interesting points in regard to the old procedure, but enough has been given to show its general character.

Conclusion

Finally one can conclude that except for mechanical improvements in the way of tools and transportation there has not been much change in engineering since the time of this old book. And if we were to compare the modern engineer with the engineer of 1700 we should find them very similar in their ideas and outlook.

Principles of Metallography as Applied to the Industry of Welding

Outline of metallography principles, metallography as applied to electric arc, thermit and oxy-acetylene welding

W. H. Ludington, Davis Bournonville Company.

Paper presented before Montreal Branch, The Engineering Institute of Canada, October 20th, 1921

Oxy-acetylene welding, electric arc welding and thermit welding each had its inception at about the same time, some twenty years ago. It is easy to imagine that the different interests behind these processes in the early days of their development, believed that each process could be developed to cover the entire field of welding. However experience and practice have proven that each of the three welding processes named above is best suited for a certain field. These three fields, of course, overlap to some extent, but from a survey of the limitations of each process, the fields for which each process is best suited may be recognized as distinct.

Oxy-Acetylene Welding

Oxy-acetylene welding consists in the manipulation of a small flame of extremely high temperature, approximately 6300 degrees Fahr. This high temperature is obtained by perfect combustion of acetylene gas, (C_2H_2) and pure oxygen (O_2) with an absolutely neutral flame, that is, a flame that causes neither oxidation nor carbonization. The combustion of acetylene gas in pure oxygen, in the proportions used, releases hydrogen, which burns with the oxygen of the atmosphere, resulting in an long, blue, envelope flame which protects the molten metal in the welds from any oxidizing action by the atmospheric oxygen. The benefits of this protecting envelope flame are peculiar to the oxy-acetylene process, and give the process advantage particularly in connection with welding of ferrous metals. The proper temperature required for the welding of the different metals, ferrous and non-ferrous, can be obtained by the manipulation of the oxy-acetylene flame, therefore, the field for oxy-acetylene welding includes practically all metals, ferrous and non-ferrous.

Electric Arc Welding

The necessary heat for fusion is obtained by breaking an electric circuit, of which the material to be welded is a part; that is, an arc is "struck" between the work and a carbon electrode or an electrode of the adding material. The temperature of the electric arc is approximately 8000 degrees Fahr. As the extreme temperature of the electric arc is applied directly to the metals being welded, the electric arc process is limited to ferrous metals. Indeed, as will be explained later in this paper, electric welding on cast iron has not been found satisfactory; therefore, its field is limited in general practice to steel.

Thermit Welding

Thermit welding is practically limited to the welding of low carbon steels, although by extensive research the process is being gradually extended to permit of a more accurate control of the carbon content of the finished weld. The thermit process depends upon the reaction of iron oxide and aluminum, whereby, after proper ignition, the aluminum decomposes the iron oxide, absorbing the oxygen and liberating relatively pure iron at an extraordinarily high temperature, incidental to the reaction. At the proper moment this bath of molten iron is liberated and caused to impinge upon the prepared sections of the break resulting in the amalgamation of a cast weld in the literal sense with the incipiently fused surfaces of the break.

From the above brief descriptions it may be supposed that the three welding processes have been found by the metal trades to be best suited for certain fields, firstly, because of the physical limitations of each process, and secondly by the consideration of economy. For instance, while certain welds can be better effected by one process they might be effected sufficiently satisfactorily and more economically by one of the other processes. However, this paper is not prepared with the idea of dealing with the technicalities involved in the various processes of welding. In fact, the several fields have been pretty well accepted by the metal trades; therefore, the writer will confine himself in this paper to a brief exposition of the principles of Metallography as applied to welding.

It is the writer's belief that by means of Metallography we are able to determine as in no other way the exact status of the various processes and the limitations of their application.

Basic Principles of Metallography

Probably not all readers of this paper are familiar with Metallography and it must be confessed that the writer's interest in the subject has been, so far, limited to its bearing on welding. Undoubtedly it would be just as well to start from the beginning and outline the basic principles of Metallography in so far as they affect the discussion in this paper.

We are principally concerned with the ferrous metals because they constitute by far the largest part of our work in the field. Iron as well as practically all other metals, upon cooling from the molten state, solidifies in the form of minute crystals, but while most crystals are mere crystals to us the metallographist has built his science upon an exact study of the form and physical characteristics of these crystals. It has been known for a long time that the modifying metals and non-metallic elements entering into ferrous alloys, the rate of cooling and numerous other factors affect to a great extent the physical characteristics of the resulting product and these same physical characteristics have been accurately defined in terms of tensile strength, hardness, elongation, etc., but the metallographist through the medium of the microscope and pyrometer has so developed his science that he is able to determine by a visual examination of the magnified crystal pretty closely what physical characteristics the structure of the metal indicates.

Pure iron crystals are termed by the metallographist, ferrite. From the very nature of the processes involved in the manufacture of iron it is practically impossible to produce, commercially, pure ferrite, although in the past few years such processes have been developed to a commercial stage. The nearest approach to pure iron heretofore has been represented in Norway iron. However, the advantageous feature of Norway iron, namely, purity, also meant a deficiency of carbon that resulted in extreme softness, which is not always an advantage. To the surprise of many users who were forced to find substitutes in American iron during the War period, when Norway iron was not obtainable, it was found that American iron could be obtained which was equal to Norway iron and better suited than it for their particular purpose; and this was the case in connection with adding material used for oxy-acetylene welding purposes.

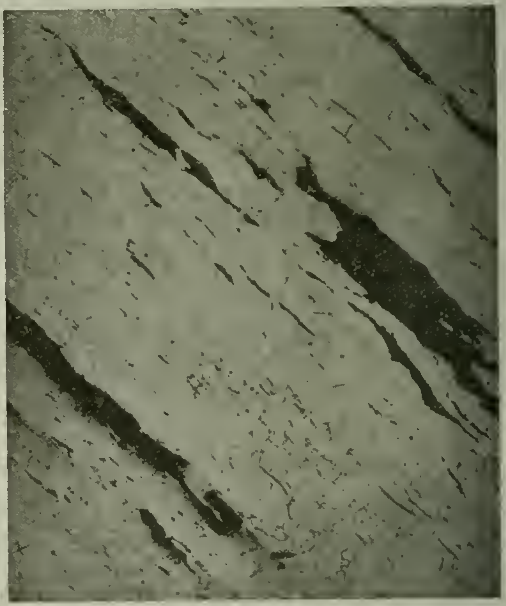


Figure 1.

Wrought Iron X 75. Ferrite Crystals and Slag Streaks.

In commercial iron, upon chemical analysis, are found carbon, manganese, sulphur and phosphorus in various quantities which are held to closely defined limits.

It is interesting and of particular importance to note how carbon can change the characteristics of otherwise pure iron so that the resulting product may be soft and ductile or hard enough to cut glass. At the high temperature involved in the metallurgy of iron, the carbon present combines with some of the iron to form iron carbide, and some or all of this iron carbide may persist throughout all subsequent mechanical and thermal treatment of the steel

However, a microscopic examination of the iron after it has cooled indicates that the iron carbide, which the metallographist calls cementite, does not exist alone as such, but has the peculiar property of further associating itself in a physical manner with more of the ferrite producing what we shall call pearlite. The cementite seems to have solidified, or rather to have separated from solid solution in thin plates between which are plates of ferrite. The polishing and etching operations used to prepare the piece for microscopic examination have so worn away the alternate plates that under the microscope they glitter with all the iridescence of mother-of-pearl, and from this resemblance to pearl the grains are termed pearlite.

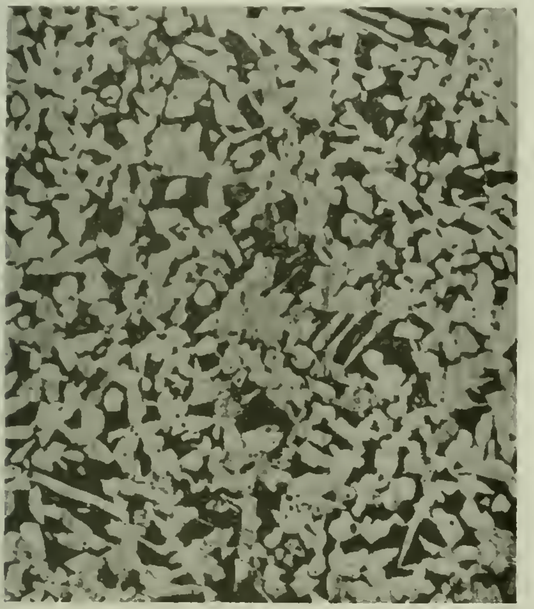


Figure 2.

Tool Steel X 750. C=1.2%. Grains of Pearlite and Intercrystalline Veins of Free Excess Cementite.

Pearlite is much stronger than ferrite, and as the carbon content of the steel is increased and the proportion of pearlite necessarily increases, a point is reached where the ferrite crystals disappear from the structure and the latter is entirely pearlite. At this point, approximately 0.89% carbon, the steel is termed eutectoid and has a tensile strength of approximately 125,000 pounds per sq. in. In comparing this with tensile strength with 50,000 pounds per sq. in. representing the strength of the ferrite, it is evident what effect the pearlite structure exercises on the physical characteristics of the metal.

Steel

The steel used in the fabrication of casting and structural shapes, by far the largest portion of that used in com merce, as a carbon content approximately 0.20% or less, while for use in boiler plates, machinery and such applications requiring extraordinary strength, steel is manufactured with carbon 0.20% and 0.40%. With 0.60% carbon and over, the steel exhibits the peculiar property of hardening under considerable heat treatment, and finds its use in the fabrication of cutting tools, etc.,

Figure 3.

Machinery Steel X 75 C= .34%. Ferrite Grystals and Intercrystalline Grains of Pearlite.

This discussion will not be concerned with the intricate phenomena involved in the hardening of steel but it will be sufficient to say that the element carbon imparts to the steel all of its hardening properties, the pearlite having the ability to change its physical characteristics and crystalline structure at certain temperatures; and by raising the steel to these temperatures and quenching and drawing, the carbon is retained in certain of these stages. It will now be seen that an increasing proportion of carbon will impart increasing hardness to the steel either as pearlite in annealed steel or as solid solution in quenched steel, and this fact will be referred to later in this dicscussion in its relation to welding.

Where extraordinary hardness is required the carbon content may be increased to 1.5 per cent, but as brittleness seems to accompany the hardness we soon approach a limit, at which, while the steel may have a desirable hardness, yet is so brittle as to be impracticable to use. The extra carbon must necessarily form free cementite because the formation of the eutectoid pearlite must obey definite physical laws; that is, when the iron carbon alloy has reached the point of carbon saturation (0.89%), mentioned above, any further increase of the carbon content beyond this point must necessarily form free cementite by precipitation from the supersaturated solid solution upon cooling. This free cementite, termed by metallographist pro-eutectoid cementite, is extremely hard and brittle, having a tensile strength of less than 5,000 pounds per square inch. It is evident then, that when the carbon content is increased up to 1.5 percent the effect of this excess cementite in annealed steel is so great as to neutralize any advantage of the pearlite present.

Cast Iron

If, however, the carbon content is increased to 2½ to 4½ per cent we again realize an iron that is applicable to commercial pursuits; we have, in fact, cast iron. We may consider cast iron as consisting structurally of steel of a variable carbon content, but containing when molten carbon in such great excess that upon cooling it is no longer all held in solution by the iron but is partly liberated as tiny flakes of graphite. These flakes of graphite are so completely distributed throughout the steel matrix that they enable the cast article to be machined with even greater expedition than if it were a steel article of very low carbon content. However, the presence of the soft, flakey graphite has a very detrimental effect upon the strength of the casting, so that we can not realize in cast iron a tensile strength greater than 30,000 to 35,000 pounds per square inch.

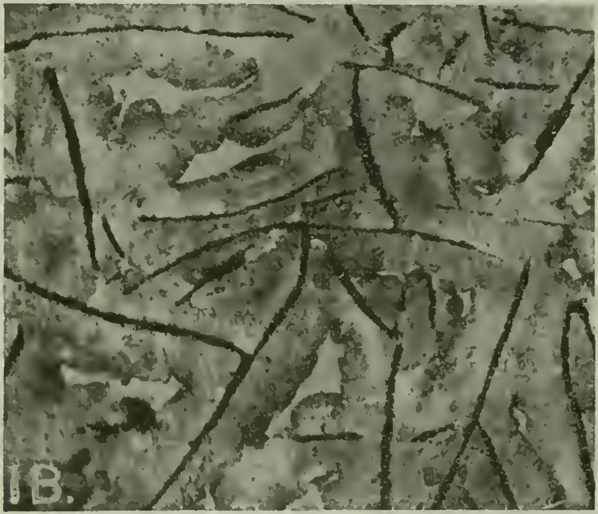


Figure 4.

Grey Cast Iron X 75. Hard Steel Matrix holding Flakes of Graphite.

Conclusion of Metallography Principles

We have stated sufficient of the basic facts of metallography to apply its principles to the science of welding; the remaining ferrous alloy, malleable cast iron, has been purposely neglected as it will be taken up in detail later on in this paper.

The oxy-acetylene process of welding is admirably suited to the fabrication of joints in ferrous alloys of practically every description. The oxy-acetylene flame is absolutely neutral in its re-action so that it remains but to develop a filler rod of the identical chemical constituents as the parent metal to produce a joint that has practically the same physical characterictics as the present metal.

Unfortunately the general run of operators in the field are not sufficiently acquainted with the principles governing the behaviour of metals under the welding torch to exercise the proper care and discretion in its manipulation. Accordingly, it is not general practice to attempt to duplicate in the filler rod the physical and chemical properties of the parent metal, but a single steel rod of low carbon is used for the fabrication of joints on all members where strength is the only factor to be considered. This rod generally has a carbon content of between 0.10 and 0. 15 percent, the latter figure being the maximum allowable on account of the increasing difficulty of manipulating under the flames a rod of increasnig carbon content.

Strange to say, a reduction of the minimum figure of 0.10% carbon seems to effect also increasing difficulty of manipulation. This factor, however, is not so prominent in its influence as another. Were a filler rod of extremely low carbon content used, such as, for instance, Norway iron, the resulting weld would be found to have a tensile strength of not over 45,000 pounds per square inch, and furthermore would have extreme ductility and elongation under stresses. This had heretofore been considered a favourable characteristic and was responsible for the universal favour accorded Norway iron; but a close analysis of the effect of extreme elongation and ductility will indicate a number of objections that would tend to nullify them completely.

Where a pressure container to be fabricated with an oxy-acetylene joint made up with Norway iron, the parent metal of the container necessarily having a carbon content of say 0.25 percent, the weaving of the container in service would subject the weld, which would be of course relatively softer, to a continual application of alternate bending stresses which would in time cause the weld to fail through fatigue. On the other hand, a filler rod with carbon content approaching 0.15 percent will produce a relatively harder weld and therefore, a weld more nearly approximating the stiffness of the parent metal, in the container. Other than this, it is possible to effect a weld using a filler rod of these characteristics so that it will have a tensile strength of 55.000 pounds per square inch and produce by far a bond of greater strength than by any other known means.

Where extreme strength and toughness is absolutely essential such as in boiler welding or repair of crankshafts a nickel steel or vanadium steel filler rod is provided with which it is not unusual to attain a tensile strength of 75, 000 pounds per square inch. These rods also permit of superficial heat treatment whereby the tensile strength may be increased to 85,000 or 90,000 pounds per square inch.

Electric Arc Welding Filler Rod

In this respect it might be well to consider the characteristics of an electric welding filler rod in comparison with a filler rod used in oxy-acetylene welding. Electric welding requires a filler rod having a carbon content of between 0.25 and 0.35 percent, due to the difficulty experienced in holding an arc with a filler rod having a lower carbon content. It appears that the presence of the carbon in the rod tends to stabilize the arc and permits of a more uniform deposition of the filler materiel and less likelihood of porosity.

Oxy-Acetylene Welding of Cast Iron

Again in cast iron welding, the oxy-acetylene process seems to enjoy a monopoly. The oxy-acetylene flame does not injure the cast iron in the slightest excepting in one particular which is overcome to a great extent in the proper design of a filler rod, the presence of blowholes in the finished weld. This factor has been investigated to the extent that it has been almost completely avoided in the cast iron filler rods provided by the reputable apparatus manufacturers. The presence of hard spots has been traced to the use of improperly devised fluxes, as well as certain imperfections in the rod, and accordingly has been taken care of by later developments.

Electric Arc Welding of Cast Iron

Up to a few years ago the electric welding process had been totally unsuited to the welding of cast iron and, as a matter of fact, the expedients resorted to even at the present time are really make-shifts and cannot be considered as a practical solution of the problem. It is impossible to utilize a cast iron filler rod in the electric process so that the weld must necessarily be effected with a steel filler rod. The core of the weld is, of course, characteristic of steel but where the weld joins the cast iron metal there is a zone of high carbon steel that is extremely brittle and friable so that there is practically no strength in the bond. The process is accordingly limited to the reclamation of castings containing blowholes, or the repair of scored locomotive cylinders. In this respect it might be well to record the use of pure nickel electrode for the repair of score marks in locomotive cylinders. The nickel, while it amalgamates with the cast iron, yet it does not absorb to any great degree its carbon, so that there is no zone of weakness as there is in the bond effected by a steel electrode.

Thermit Welding of Cast Iron

Thermit welding has of late entered the field of cast iron welding but to a superficial degree. The Thermit reaction of aluminum and iron oxide is utilized to produce a high temperature and this in turn imparts to a mixture of cast iron the necessary heat to raise the latter to a fluid condition. The process is cumbersome and costly, however, and does not enjoy any considerable application.

Malleable Cast Iron

Malleable cast iron has consistently taxed our ingenuity so that a weld may be effected having all of the characteristics of the original material. The peculiar factors involved can best be understood by an exposition of the metallography of malleable cast iron. It is found that if practically the identical mixture of cast iron that would ordinarily produce a soft gray iron casting be cast against an iron chill, or otherwise suddenly chilled, the carbon would not precipitate as graphite but would be retained by the iron to produce a considerable excess of cementite. If, now, this casting which is termed a "chilled cast iron" or "white cast iron" casting, be annealed at a red heat for a number of days, a startling transformation is found to have occurred in its structure. The cementite has been completely decomposed as well as the pearlite, but while the carbon is necessarily precipitated it is not distributed as is the flake graphite in grey cast iron, but collects in nodules as amorphous carbon and in this manner does not break up the continuity of ferrite crystals. Accordingly a malleable iron casting may have a ductility and tensile strength closely approaching that of a low carbon iron. However, if this mass is re-fused, as it necessarily is in the welding process, the ferrite will re-absorb the carbon and upon cooling the mass will revert to the structure of a white grey cast iron and of a poor one at that. It is now universal practice in effecting a joint between malleable iron parts to use a bronze filler rod and be satisfied with what is practically a braze. It is not usually, however, to realize a tensile strength in this way approaching 30,000 pounds per square inch and as the braze can be reinforced the bond may approach a tensile strength equal to if not greater than that of the parent metal.

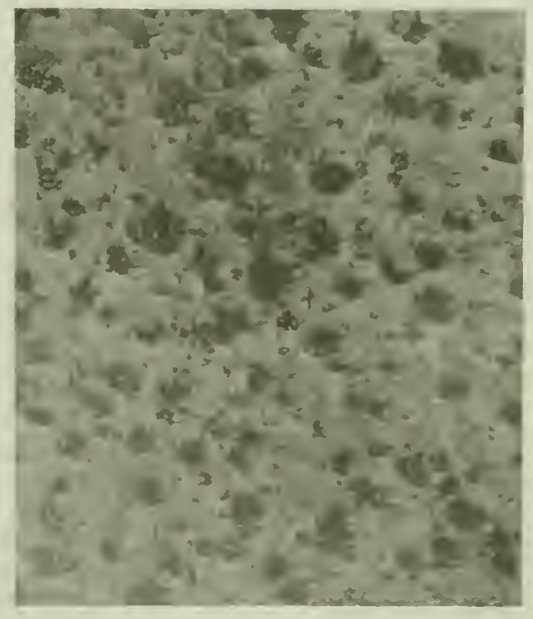


Figure 5.
Malleable Cast Iron X 75. Ferrite Mass with Free Carbon in Nodules instead of Flakes.

Non Ferrous Alloys

Again, in the non-ferrous alloys oxy-acetylene welding stands alone. Practically all brasses and bronzes can be welded, using, here also, a single filler rod, generally Tobin Bronze; or where a relatively low melting point spelter is required a 60 - 40 mixture. By the manipulation of the portions of copper and zinc the melting point of the spelter may be reduced to 1,500 degrees Fahr.

Aluminum is most readily welded by the oxy-acetylene process and for this purpose a filler rod approximating the standard No. 12 alloy is used. It is not unusual to produce an oxy-acetylene weld in aluminum having a considerably higher tensile strength than the parent metal.

Conclusion

While it is not reasonable to expect that every welder will be a metallographist, it is apparent that by the application of metallography, the finished welds can be thoroughly examined and the proper process so developed that the operators can be trained to make the best welds with of course, due regard for efficiency and economy.

It should be noted that the photographs of typical structures are not made from prepared sections of actual welds.

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Annual Meeting Announcement

The annual general meeting of *The Engineering Institute of Canada* will be held at Montreal on Tuesday, January 24th, 1922, at ten o'clock A.M.

At this meeting the formal business of the annual general meeting will be presented. The agenda will consist for the most part of appointments of scrutineers; appointment of auditors; reception of reports, (a) report of Council, (b) reports of committees, (c) reports of Branches; new business; reports of scrutineers announcing election of officers.

Charters for Branches

In order that the various Branches should have an evidence of their authority to conduct their affairs as a Branch of *The Institute*, it was decided at a recent meeting of Council that each Branch should be presented, in a form suitable for framing, a charter bearing the seal of *The Institute*, and the signatures of its officers.

At the present time consideration is being given to the form which would by most suitable, and as soon as a design has been accepted, each Branch of *The Institute* is to receive a copy.

New Branches

Evidence that the engineering profession is becoming better organized from year to year is shown by the fact that, at the meeting of Council held on October 13st, applications were received for authority to establish Branches of *The Institute* from Lethbridge, Alta, and London, Ont. At this meeting approval was given to the petitions in both cases.

The petitions presented were:— "We, the undersigned Corporate Members of *The Institute* beg to apply, under section 49 of the By-laws, for authority to form a Branch at London, Ontario, to be called "The London Branch of *The Engineering Institute of Canada*"

H. B. R. Craig, M.E.I.C.
A. H. Smith, M.E.I.C.
J. Davis Barnett, M.E.I.C.
J. A. Bell, M.E.I.C.
A. J. Sterns, M.E.I.C.
R. I. Olmsted, A.M.E.I.C.
W. J. Forbes-Mitchell, A.M.E.I.C.
F. A. Bell, A.M.E.I.C.
W. C. Miller, A.M.E.I.C.
W. J. Shaw, Jr., A.M.E.I.C.
Ibbotson Leonard, A.M.E.I.C.
J. R. Rostron, A.M.E.I.C.
Chas. Talbot, A.M.E.I.C.
H. S. Philips, A.M.E.I.C.
H. A. Brazier, A.M.E.I.C.
J. E. Wright, A.M.E.I.C.
W. E. Stephens, A.M.E.I.C.
Robert McKillop, A.M.E.I.C.
A. M. Kirkpatrick, A.M.E.I.C.
F. J. Bridges, Jr. E.I.C.
G. H. Chalmers, Jr. E.I.C.
A. A. Anderson, Jr. E.I.C.

"We the undersigned Corporate Members of *The Engineering Institute of Canada*, resident at Lethbridge, desire to form a Branch of *The Institute* at Lethbridge, and hereby petition you for authority to organize the Lethbridge Branch:—

Sam G. Porter, M.E.I.C.
H. B. Muckleston, M.E.I.C.
P. M. Sauder, M.E.I.C.
F. M. Wood, A.M.E.I.C.
F. S. Dyke, A.M.E.I.C.
C. L. Dodge, A.M.E.I.C.
H. G. Cochrane, A.M.E.I.C.
Chas. Raley, A.M.E.I.C.
R. S. Lawrence, A.M.E.I.C.

C. M. Arnold, M.E.I.C.
G. N. Houston, M.E.I.C.
J. J. Hanna, A.M.E.I.C.
H. W. Meech, A.M.E.I.C.
C. D. Mackintosh, A.M.E.I.C.

Following granting the petition the London engineers arranged for an organization dinner meeting at the Tecumseh Hotel on Wednesday, November 16th, at which there were present forty-five. Enlivened by the singing of songs and characterized by a spirit of good fellow-ship, the London Branch was organized amid considerable enthusiasm, and with a heartiness that anticipates a successful future of activity and usefulness for the London Branch.

An account of this meeting will be found elsewhere, and it is expected that a description of the organization of the Lethbridge Branch will appear at an early date.

Proposed change in the By-laws

At the Council meeting held on October thirty-first a petition was received proposing to amend section fifty-two of the by-laws.

In the letter of transmittal the reasons for such a change are given below:—

"1.—That without desiring to advance the argument that one officer is more necessary or more meritorious than the other, we would point out that continuity for at least a year seems just as desirable in the case of the secretary-treasurer as in the case of the chairman, because while it is true that the latter is in close touch with the affairs of the Branch, his knowledge relates more to the general activities of the organization, the secretary alone carrying the details. First hand information in both cases seems necessary to the best working of the incoming executive.

2. Besides being an advantage to the Branch, as outlined above, and in that way to *The Institute* as a whole, it is also a compliment to the individual that appears to be due to him if for no other reason than as a slight acknowledgement for the work that he, with his chairman, has done in the past.

3. Lastly, there can scarcely be anything argued against the suggestion, because Council permits certain of the Branches to maintain such a requirement in their by-laws and to carry out the practice that we are suggesting be made universal."

This publication of the petition which follows is an official notice of the proposed change as provided for in the by-laws:—

> "1. Whereas: Section fifty-two of the by-laws of *The Institute* provides that the immediate past chairman of the Branch shall be a member of the executive committee of that Branch, but makes no corresponding provision as to the immediate past secretary-treasurer, and,
>
> 2. Whereas: It seems most desirable to the signers hereof that in all cases the past secretary-treasurer should also be a member of the executive committee of his Branch for at least one year following his term of office, which as a matter of fact is already provided for in the by-laws of certain of the Branches, and,
>
> 3. Whereas: Section seventy-five of the by-laws of *The Institute* governing amendments thereto requires that proposals to amend existing by-laws shall be presented in writing to the Council, and signed by at least twenty members,
>
> 4. Therefore: The undersigned pray: That Council take the matter under advisement and issue instructions for the taking of a ballot on the proposal, which we hereby submit, that section fifty-two of *The Institute* by-laws be amended so as to provide that the immediate past secretary-treasurer of a Branch shall be a member of the managing committee of that Branch for at least one year following his term of office.
>
> 5. As a wording of section fifty-two that would accomplish what we have in mind, we suggest:

"Each Branch shall be managed by an executive committee or managing committee consisting of:

(a) A Branch chairman, a Branch secretary-treasurer, and not less than three other members, all to be known as elected members and to be balloted for by all members of the Branch entitled to vote at branch elections,

(b) Those members of council resident within the jurisdiction of the Branch, to be known as ex-officio members, and,

(c) The immediate past chairman and the immediate past secretary-treasurer of the branch to be known as members emeriti, these latter to be members for one year immediately following their term of office."

(Signed)

A. St. Laurent, M.E.I.C., I. F. Uniacke, M.E.I.C., S. J. Chapleau, M.E.I.C., C. R. Coutlee, M.E.I.C., A. J. Matheson, M.E.I.C., S. B. Johnson, M.E.I.C., J. B. Challies, M.E.I.C., A. H. Harkness, M.E.I.C., R. O. Wynne-Roberts, M.E.IC. H. L. Seymour, A.M.E.I.C., Frank Barber, M.E.I.C., Willis Chipman, M.E.I.C., M. F. Cochrane A.M.E.I.C. R. de B. Corriveau, M.E.I.C., J. B. McRae, M.E.I.C., A. A. Dion, M.E.I.C., G. B. Dodge, M.E.I.C., J. E. N. Cauchon, A.M.E.I.C., F. C. Askwith, A.M.E.I.C., K. M. Cameron, M.E.I.C., R. J. Durley, M.E.I.C., A. B. Lambe, A:M.E.I.C., J. E. Brown, M.E.I.C., A. F. Macallum, M.E.I.C.

Industrial Waste

Owing to the importance of the subject of industrial waste from an engineering view-point, Council has constituted an Industrial Waste Committee, under the Chairmanship of Wills Maclachlan, M.E.I.C. of Toronto, who was authorized to organize the work of this Committee with a view to active service. As Mr. Maclachlan's ability in an organizing capacity is well known, it is anticipated that the results of the work of this committee in co-operation with the Committees of United States engineering organizations, who have been at work on this problem for some time, will be beneficial to the industrial life of Canada, and to the engineering profession.

Institute Medals

Since 1890, and until a few years ago the Gzowski medal represented the one award of merit for a paper presented on an engineering subject during the year. A few years ago, J. H. Plummer provided a fund for a medal to be awarded for the best paper on a metallurgical or chemical subject, and shortly after that, Lt. Col. Leonard donated the Leonard medal as an Institute medal for the best paper on a mining subject, presented either to *The Engineering Institute*, or the Canadian Institute of Mining and Metallurgy.

Recently the present Leonard and Plummer medal Committee has had in hand the question of a suitable design for these two medals, and the approval of the donors has been given to the designs submitted, illustration of which will appear when the offical approval has been given by the Council of *The Institute*.

In order that the original medal, established by the late Sir Casimir Gzowski should be more in harmony with the other medals, and instead of being cast in silver should be of gold, the Council of *The Institute* resolved that, with the consent of the heirs of the late Sir Casimir Gzowski, a change would be made, and in future the Gzowski medal, representing the award for the best paper in Civil Engineering, should be of gold. On communicating with C. S. Gzowski Jr., M.E.I.C., a reply was received from his father, C. S. Gzowski, Esq., who gave the necessary authority to have a change made.

It is expected that a further announcement regarding additional medals will be made at the Annual Meeting.

The Universities and the Engineering Profession

A rather interesting statistical investigation was begun in 1919 under the auspices of the American Association of Collegiate Registrars into the question of what proportion of the distinguished engineers of the U.A.S. were college graduates and in how far the standing in college of those who were graduates was reflected in their subsequent success in professional practice.

The results of this investigation have just been published in an article entitled "Scholarship and Eminence in Engineering" by Raymond Walters, registrar of Lehigh University, which appears in the issue of the magazine entitled "Engineering Education" for April, 1921. The study has been made possible by the co-operation of the authorities of 75 of the leading universities, colleges and technical schools of the United States.

The first difficulty to be overcome was the definition of what is to be taken as constituting a "Distinguished Engineer." The criterion adopted was that of having served: (a) as an officer; (b) on a standing committee; (c) as a representative of any one of the four great engineering societies of the United States at any time during a period of five years — 1915-1919 inclusive. These societies are the:

American Society of Civil Engineers
American Society of Mechanical Engineers
American Institute of Electrical Engineers
American Institute of Mining and Metallurgical Engineers.

The distinguished engineers thus selected number 730.

While the list certainly does not include all the eminent engineers in the United States, it is undoubtedly a list of eminent engineers sufficiently large to furnish a significant ground for generalization, these gentlemen having been selected from the roll of an annual total of 40,000 engineers constituting the membership of the societies in question.

Of these 730 distinguished engineers, 580, or almost exactly 80 percent, are found to be college graduates.

These figures have an added significance when it is remembered that most of the men on this list are men well over fifty years of age and that they accordingly graduated in the late '70's, the '80's and the early '90's, when attendance at colleges and technical schools was relatively small in the United States, many men who were ambitious to become engineers usually beginning their carreers in surveying camps, machine shops and railway offices.

The educational record of these 730 distinguished engineers was as follows:—

	Number	Percentage
College graduates............	580	79.5
Attended college but did not graduate................	35	4.8
School, training only.......	115	15.8

It was found possible to go one step further and determine the standing in college attained by 392 of these 580 distinguished engineers who were college graduates. The records of the others could not, for various reasons, be secured. If each graduating class is divided into fifths as follows, the highest fifth, (or 20 p. c.) the second fifth, the third, fourth and lowest fifth, then the standing of these engineers in college was as follows:—

Highest fifth.......	46.4 per cent
Second "	27.8 " "
Third "	18.3 " "
Fourth "	3.6 " "
Lowest "	3.8 " "

To sum up, the study goes to show that:—

(1) Among distinguished engineers the great majority are university or college graduates.

(2) That of the men following courses of university or collegiate study, those who completed their course and graduated are much more likely to achieve success than those who follow a partial course of study only.

(3) Of those students who did complete their studies and graduated, those who at their graduation made a low standing were much less successful in their subsequent professional life than those who attained a high standing at graduation.

Conditions in Canada being very similar to these in the United States, it might be expected that these conclusions would be equally true of the Dominion. It seemed, however, a matter of interest to ascertain whether the same preponderance of college graduates was to be found among engineers of distinction in Canada as in the case of the United States.

We have in Canada only two great engineering societies, *The Engineering Institute of Canada* and the Canadian Institute of Mining and Metallurgy. Through the kindness of Fraser S. Keith and Geo. C. Mackenzie, the secretaries of these societies, an examination has been made of the records of these societies.

The number of engineers in Canada is of course much smaller than in the United States and the number of engineers of special prominence is correspondingly less. Neither has it been possible to make such a thorough study of even this smaller field as that made by the American Registrars Association.

Taking, however, the membership of the Council of the Canadian Society of Civil Engineers, (i.e. *The Engineering Institute of Canada*),during the past ten years, the records show the following figures:

	1912	1913	1914	1915	1916
Graduates..........	20	18	22	23	23
%	62.5	64.4	78.6	82.2	82.2
Non Graduates......	8	10	6	5	5
%	37.5	35.6	21.4	19.8	19.8
	1917	1918	1919	1920	1921
Graduates..........	22	29	29	30	35
%	75.9	82.8	82.8	81.1	87.5
Non Graduates......	7	6	6	7	5
%	24.1	17.2	17.2	18.9	12.5

This shows a regular and progressive rise in the proportion of university graduates on the Council as compared with engineers who have not obtained a college training.

It will thus be seen that of the 316 persons (although in some cases the same person may have served for more than one year) who have been members of the Council during the period of 10 years covered by this table, 78 per cent were college graduates, a number almost identical with that representing the proportion of college trained men among the distinguished engineers of the United States. The Secretary of *The Engineering Institute of Canada* further states that "a casual glimpse into the records of the earlier days of the Canadian Society of Civil Engineers shows a large proportion of non-graduates, that is, the majority of prominent engineers of twenty to thirty years ago were not college graduates."

Turning now to the Canadian Mining Institute (now the Canadian Institute of Mining and Metallurgy), the records show that, taking the same period embracing the past ten years, the Council of this society has consisted of gentlemen of whom 73 per cent were graduates and 27 per cent were non-graduates, a figure again in general agreement with that of *The Engineering Institute of Canada* and for the four great societies of the United States. Taking the total membership of the Executives of the sixteen branches of the C.I.M.M. throughout the Dominion in the year 1920, it is found that 58 per cent are graduates and 42 per cent are not graduates.

It must be remembered, however, in this connection that the membership of the Canadian Institute of Mining and Metallurgy is not composed exclusively of engineers but embraces also other persons connected with the mining industry, which probably accounts for the lower proportion of college graduates in its council and executive as compared with *The Engineering Institute of Canada*, which is a strictly professional society.

Frank D. Adams, F.R.S., Hon. M.E.I.C.,
Dean of the Faculty of Applied Science,
McGill University.

CORRESPONDENCE

The Metric System

Editor, "*Journal:* - Nov. 9, 1921

Dear Sir:

I have read Mr. Molitor's paper on "The Metric System of Weights and Measures" in the November "*Journal*", with much pleasure. In the paper, mention is made of the fact that surveying instruments would be unaffected by a general change to the metric system, but that the cheaper accessories like levelling rods, tapes and scales could be replaced with metric tools when necessary.

In this connection, it is of interest to note that the Geodetic Survey of Canada use the metric system for the linear measurements in the triangulation networks. I believe the United States Coast and Geodetic Survey do the same.

To enter into details, the base lines are measured with 50 metre tapes, under a tension of 15 kilograms. The length of the base line is reported in metres. The lengths of the different lines in the triangulation are calculated in metres, and are shown in the final report in metres. The bars that are used in the standardization building are 1 metre and 5 metre bars graduated on the metric system.

In the Meteorological Section of the Surveys Laboratory there are several pieces of equipment, all graduated in metres and millimetres. On the one metre rule there is a subsidiary scale of inches. All tapes and other measures of length used on Dominion Lands Surveys are standardized in this section of the Laboratory.

As matters stand at present, the surveyor does his topographical work using the English system, and draws up his plans in that system to present to the public. However, if he wants to use the data supplied by the Geodetic Survey of Canada to control his work, or if he wants his measures of length checked against a standard, then it is necessry to convert from the popular system to the metrical system.

As far as the surveyor himself is concerned, it is quite possible that the additional facility with which he can refer to the accurate governing surveys and standards of length would offset the inconvenience of changing his own tapes, etc.

Yours very truly,

John R. Dunbar, S.E.I.C.

148 East Ave., N.,
Hamilton, Ontario.

In Mesopotamia

Editor, *Journal:—*

Dear Sir:

The work here is very interesting and I hope to prepare a paper on it later. The only trouble is that the political situation is very bad. The new king is all for irrigation which really is the only thing they have to give the Arab, but they've got no money and cannot get it. The curse of the whole thing is the Indian system that is in force. It's a result of the army and too expensive for the amount of revenue. Personally I do not think it will last much longer. I don't like the way we have to work or the conditions, and I firmly believe that we will all be let out by December 31st. I expect a visit from the king himself to-morrow. When he sees what we are doing he may make another effort, but I doubt it.

At present I am supposed to be in charge of the whole Euphrates River and specially repairs to the Hundiyah Barrage which I had one of three divisions wrecked during the rebellion last fall. It's a big job and going very well so far, except that material is very hard to get.

We may get home this coming winter. It all depends on the way the political situation turns out.

Give my best to all my friends you meet in Montreal and Ottawa and believe me,

Yours sincerely,
G. B. HULL, A.M.E.I.C.

Hindiyah Barrage,
Mesopotamia.

Status of "Junior" and "Student" Members

Nov. 17, 1921

Editor "*Journal*",
Dear Sir:—

For some time past there has been quite a lot of correspondence in the "*Journal*" regarding classes of membership in "*The Institute*". Several members seem to be in favour of combining the present classes of "Student" and "Junior", the contention being that the two classes are essentially the same. This is not so. They are fundamentally different.

At present, a "Student" is a young man, in many cases still a boy, who is starting in to study engineering. He has no income, but has to spend money too freely for his own peace of mind on fees and living expenses. He has had no experience in engineering matters, so he is not qualified to vote. He is willing to watch senior members of *The Institute* in their deliberations, and to learn from them how engineering matters should be handled. His object in life is to learn as much as he can, but he is not yet ready to apply what knowledge he has.

The "Junior", on the other hand, has had some engineering experience. He has real money coming in. His experience qualifies him to vote on certain matters. He is still learning, but he wants some opportunity to apply what knowledge he has accumulated.

If the present classes of "Junior" and "Student" are combined, the new class cannot properly replace the two present ones. I think it can be taken for granted that the new class will be permitted to vote on certain matters. This would give the Student more power than he can intelligently handle, and in 99 cases out of 100, more than he desires. In the matter of fees, if they were made to correspond to the present Student fees, a large source of revenue to "*The Institute*" would be unnecessarily cut off. If they were made to correspond to the present Junior fees, practically the entire student membership would be lost.

In my own case if I had been required to pay $10 entrance fee and $10 a year annual dues, I would never have become associated with the "Canadian Society of Civil Engineers" in my Freshman year at college. Further, through my student membership I have become interested in "*Institute*" matters, and within the next few months I shall apply for transfer to the next higher grade. If I were not already a Student member it is probable that it would be two or three years more before I would enter an application for admission. In this one isolated case, higher fees for Student members would have meant one Student less for five years, and one Junior less for at least two or three years.

In all the correspondence I have noticed on this matter, I have seen no *reasons* advanced for combining the classes of Junior and Student. In every case it has been merely some corporate member's personal opinion. I have tried to show that there are reasons for keeping the two classes distinct, and that it would hurt "*The Institute*" to combine the two classes.

Yours very truly,
JOHN R. DUNBAR, S.E.I.C.

148 East Ave. N.,
Hamilton, Ont.

ELECTIONS AND TRANSFERS

At the meeting of Council held on October 31st, 1921, the following elections and transfers were effected:—

Members

Murray Douglas Alexander Kennedy, mgr., Tretheway Silver Cobalt Mine Ltd., Gowganda.

Robert John Marshall, B.A.Sc. (Univ. of Toronto), president, Canadian Inspection & Testing Co., Ltd., Toronto.

John Stadler, asst. mgr., Belgo Canadian Pulp & Paper Co., Shawinigan Falls.

Miles Walker, Gagetown, N.B.

Associate Members

I. Walter Buckley, supt., Dominion Iron & Steel Co., Sydney, N.S.

Harold Cassels Chipman, asst. chief dftsman, Dominion Coal Company, Glace Bay, N.S.

John Hugh Fraser, mech. supt., Dominion Iron & Steel Company, Sydney, N.S.

Bertrand Hagarty, Winnipeg, Man.

Thomas Philip Hamel, building designer, Three Rivers Pulp & Paper Co., Ltd., Three Rivers, Que.

John Brown Hamilton, Town Engr., Estevan, Sask.

Sidney Harding, D.L.S., member of firm, Parsons Engineering Co., Regina, Sask.

Junior

Ralph Wallace Donaldson, dftsman, Barber, Wynne-Roberts and Seymour, Toronto.

Transferred from the class of Associate Member to that of Member.

Victor Michie, munic. engr., Municipality of Morton, Boissevain, Man.

Transferred from the class of Junior to that of Associate Member.

Georges Sandles Brown, asst. engr., D.N.R., C.P.R., Lethbridge, Alta.

James Wardrope Dick Farrell, B.A., B.Sc., (Queen's Univ.) asst. supt., Waterworks, Regina, Sask.

Edward Hughes, engr., Crow's Nest Pass Coal Co., Ltd., Fernie, B.C.

William George Mawhinney, B.C.E., (Univ. of Man.) munic. engr., rural muninipality of Ellice, St. Lazare, Man.

Donald DeCourcy Ross-Ross, B.Sc., (McGill Univ.), industrial engr., Canadian Consolidated Rubber Co., Montreal.

Transferred from the class of Student to that of Junior.

John Howard Hickey, B.Sc. (C.E.), (N.S. Tech., Col.,), asst. engr., city engr's office, Halifax, N. S.

Guy Adamson Lindsay, B.Sc., (McGill Univ.), hydraulic engr., St. Lawrence River Improvement Investigation, Ottawa, Ont.

Grant Price Pearson, B.A.Sc. (Univ. of Tor.), munic. engr., munic. of St. Andrews, Clandeboye, Man.

At the meeting of Council held on November 22nd, 1921, the following elections and transfers were effected:—

Members

William Irvine Hay, principal surveyor, the British Corpn. for the Survey & Registry of Shipping, Montreal, Que.

Earl Ewing Litz, combustion engr., Algoma Steel Corpn. Ltd., Sault Ste. Marie, Ont.

Lawrence Thomas Martin, commissioner, T. & N. O. Rly., managing director, Great Lakes Dredging Co., Ltd., & managing partner, O'Brien & Martin, Ottawa, Ont.

Associate Members

John Cummings, Victoria, B.C.

Charles Harvey, B.A.Sc. Univ. Toronto, insp'r of bldg. constrn., Riordon Company, Temiskaming, Que.

Horace Henry Hawkes, struct'l designer, Laurentide Company, Grand Mere, Que.

James A. Kelso, B.Sc., M.Sc., Queen's Univ., director, industrial laboratories Univ. of Alberta, prov. analyst, Prov. of Alberta, and consltg. chem. engr., Edmonton Alta.

David Kirk Lyons, Dominion Iron & Steel Co., Sydney, N.S.

James Boustead Newton, dist. irrig. officer in charge of special project, dist. No. I, Public Works, Mesopotamia, Amarah, Mesopotamia.

Norman Chester Ralston, asst. dist. engr., Dept. P.W. Canada, Halifax, N.S.

Richard Curtis Smith, B.Sc., Tufts College, Mass., contract engr., Canadian Mead-Morrison Co., Ltd., Montreal Que.

William Smith Wilson, tech. engr., Dominion, Iron & Steel Co., Sydney, N.S.

Juniors

Jean Jacques Lanctot, road inspr., Ministry of Roads, Prov. of Que.

John Courtenay Mews, dftsman., N.S. Steel & Coal Co., Wabana, Nfld.

Jean Francis Wickenden, B.Sc., McGill Univ., contracting engr., Horton Steel Works Limited, Bridgeburg, Ont.

Transferred from the class of Associate Member to that of Member

Walter James Armstrong, M.E., Cornell Univ., engr. in charge engr'g dept., Ross & Macdonald, Montreal.

Russell Sutherland Smart, M.E. Univ. Toronto, B.A. Queen's Univ., in charge Ottawa office, Fetherstonhaugh & Co., and Fetherstonhaugh & Smart, Patent Solicitors, Engineers & Draughtsmen.

Transferred from the class of Student to that of Associate Member

Louis Philippe Vezina, B.A.Sc., Univ. Toronto, Chicoutimi, Que.

Canadian Engineering Standards Association, Standardization in Belgium

A communication has been received from the Association Belge de Standardisation (A.B.S.) advising that the following publications have been issued by that body:

No. 1.—Rules for the Construction of Steel Roof Trusses.
No. 2.—Rules for the Construction of Steel Tanks.
No. 3.—Rules for the Construction of Galvanized Corrugated Roofs and Partitions.
No. 4.—Standardization of Shafts and Pulleys.
No. 5.—Standardization of Steel Bridges.
No. 6.—Standardization of Bolts and Rivets.
No. 7.—Standard Requirements for Electrical Machinery.

The pamphlets Nos. 1. 2, 3, and 5 give directions as to the constants used and methods to be followed in the working out of the necessary calculations; they prescribe proper workshop methods and contain also provisions as to the delivery and erection of the structures. Conditions relating to terms of guarantee, payment, etc., are also included. The quality of material will be dealt with in a further publication.

Pamphlet No. 4, Standardization of Shafts and Pulleys, deals with the diameters of shafts and the principal dimensions of pulleys, standard sizes being prescribed with a view of lessening the number of types to be regularly furnished by Belgian manufactures.

Pamphlet No. 6, Standardization of Bolts and Rivets, gives tables of dimensions of bolts from 6½ to 77 mm. and rivets from 6½ to 25½ mm.

The A.B.S. has also published a sheet or poster on Advice to Firemen, which is intended for use in the boiler room and gives brief directions as to methods of firing, preparation of coal, thickness of fire, methods of cleaning fires, and other instructions leading to economy in fuel. Directions regarding precautions as to safety are also included, together with information as to proper methods of boiler cleaning and the working of super-heaters.

Pamphlet No. 7, Standard Requirements for the Inspection of Electrical Machinery and Transformers. This has been drawn up by the Belgian Electro-Technical Committee for issue by the A.B.S. and includes two parts, the first containing definitions and particulars required in preparing requiries or tendering for electrical machinery, and the second part dealing with the conditions to be satisfied by such machinery as regards permissible temperature rise, dielectric strength of insulation, mechanical tests, efficiency, and losses.

These publications can be obtained from the Secretary, Association Belge de Standardisation, 33 Rue Ducale, Brussels.

Addresses Wanted

With the compilation of the 1922 Year-Book under way and for purposes of general record it is necessary to locate if possible those members whose addresses are not known. Any information regarding the addresses of members on the list printed below will be greatly appreciated by the Secretary.

Members

Allison, John Logie,
*Canniff, Clarkson Moffat,
*Daw, Hilder, (Major)
Garden, Charles,
George, F. J.
Haney, Michael, J.
MacDonald, Charles, LL.D.
*MacLachlan, J.S.,
*Macpherson, Osborne Cluny, (Lieut.)
Maximoff, Sergius P.,
Ord, L. R., D.L.S.,
Press, William Joseph,
*Sims, Henry Bueth,
Sothman, P.W.,
Welch, Archibald,

Associate Members

*Adam, William Alexander, (Capt., M.C.)
*Adamson, Ernest Kinnear,
Archibald, Charles Lawrence,
Baggs, Edwin,
*Barton, Robert A., (Lieut.)
Beck, Herbert Philip,
Bell, Charles Burnby,
*Bidwell, Leonard M.,
*Bishop, Reginald W.,
Black, William D.,
*Bowie, Jas.,
*Brunner, Godfrey H.,
Burnett, Archibald,
Busso, Edwards Guiseppe Mario,
*Butler, Geo. A.,
*Caddell, William Persse, (Capt.)
*Cahan, J. F., (Lieut.)
Canfield, Fr. O.,
*Chappell, Frank, (Lieut.)
*Chivers, C. W. U., (Capt.)
Chown, Reginald,
Clarke, Ernest R.,
*D'Abbadie, Camille A.,
*deLestang, Paul L. G., (Lieut.)
*Donaldson, John M., (Capt.)
Duckworth, Walter R.,
*Duff, Prescott Blagdon, (Lieut.)
Elliott, John S.,
*Ellis, J. G. St. J. (Reported to have been killed in action)
Flanagan, Oliver L.,
Flood, John Garnar,
Frigon, A.,
*Garrow, Alan Balfour, (Capt.)
Gordon, John,
*Grant, LeRoy Fraser, (Major)
Gunn, Luther Collins,
*Hamilton, George M., (Lieut.)
*Handley, John,
Hanson, Edward, Christian, Adair,
*Hay, William Wren,
*Heywood, E. P.., (Lieut.)
*Hodgson, H. M. T.
Huestis, Harry E.,
Keefer, Edward C.,
King, John L.,
Kolling, Peter Ingvar,
Krumm, Carl O. W.,
LaForest, G. B.,
Lefebvre, J. V. Stanislas,
*Lockhart, Wm. D.,
Macdonald, John, (Lieut.)
Mackay, Angus G.,
*Mackenzie, John A., (Major, D.S.O.)
*Macklem, Oliver T., (Staff Capt.)
*MacLachlan, James B.,
MacLaren, Walter Corning,
*McLean, John Rose, (Lieut.)
*McPhee, Murdoch N., (Lieut.)
*Moorhouse, W. Norwood,
*Murphy, Philip Frederick, (2nd. Lieut)
*Murton, James G., (Major)
Newton, Christopher Anthony,
*Nowlan, Arthur,
*Oborn, Stanley Mill,
*O'Leary, H. Gordon,
*Patrick, Khosru Sorab,
Payne, Caleb,
*Pickering, Francis Alex.,
Plumb, Maurice William,
*Powell, Alan Torrance, (Major)
*Pullen, Ernest Fleetwood, (Major)
*Reid, A. C.,
*Reynolds, George, (Lieut.)
*Robinson, Thomas E.,
Ross, Charles Raymond,
*Rowley, Harold G.,
*Saunders, Walter L., (Lieut.)
Saynor, Fred,
Sharpe, D. Neville,
*Simpson, Rupert, (Capt.)
*Smith, A. Parker, (Capt.)
Smith, Herbert Nevile,
Smith, W. C.,
*Sohier, Raymond, (Croix de Guerre)
*Stavert, William D., (Lieut.)
Stewart, Norman G.,
*Thorne, Stuart M., (Major)
Van Every, Wm. Wishart,
*Walker, T. Molineux, (Capt.)
*Walker, Wm. John,
*Watts, Alfred Douglas, (Major)
*Wickham, James Thomas,
Zverina, Jan.

Juniors

*Adams, Wm. D.,
*Allan, H. D. (Lieut.)
*Badgley, L. A.,
Bathen, Johan,
*Booth, Charles D. G.,
Boulton, C. A.,
*Brown, H. L.,
Bryant, Earlham,
Burton, E. C.,
*Campbell, W. I. H.,
Clendinning, James,
*Dansereau, J. A (Lieut-Col.)
*De Cardiallac, Galliot,
*Dixon, G. B.
*Draper, W. H.
*Fairn, A. S. (Capt.)
*Ferris, C. B. (Major)
Forest, Albert,
*Fraser, C. E. (Capt.)
George, W. B.
*Greening, E. C.
Hamilton, J. R.
Holland, H. D.
Hughes, H. C.
*Jones, John Henry (Lieut.)
*Junkin, R. L. (Capt. M.C.)
Lacroix, P. A.
Lamb, G. J.
*Leger, A.
McKnight, R.
*McNeil, O. M. (Lieut.)
*McRae, J. P.
*Mills, Leslie Gordon,
*Mitchell, J. Cameron, (Capt.)
*Moody, F. H. (Major)
*Moran, P. J.
*Moxon, G. B.
*Passy, P. de Lacy
Patenaude, Jos T. Z.
*Penny, Edgar (Capt.)
*Richardson, C. E.
*Stewart, H. W. (Lieut.)
Taylor, W. H.
*Theriault, A. (Major)
Tippet, H. Jackson
*Wetmore, Fred W. C.
*Willrich, C. G. (Lieut.)
*Worthington, A. N. (Major)

Students

Abel, John S.
*Adlard, L. S.
*Anderson, A. C.
Barnes, F. H.
*Bayne, C. MacV.
*Birchard, E. R.
*Bremner, F. E. A.
*Brouse, E. D.
Brow, James Barrett,
*Brown, Leo. B. (Lieut.)
*Browne, William Joseph,
Cameron, Geo. Donald West,
*Cameron, John Reginald,
*Cann, Frederick Lorne, (Lieut.)
*Carnsew, C. N. T.
Cromwell, H. Roy,
Cumming, Chas. H.
*Dawson, J. K.
*DePaul, M. J.
Desmaisons, O.
Deschamp, A.
Dick, V. W.
Dickson, Wm. J.
Donaldson, Arthur,
*Dornie, R. W.
*Duguid, A. F.
Dunbar, Prosper Gerald,
*Dunlop, H. J.(Lieut.)
*Eaton, H. T.
*Ellis, Fred. James
Farrow, J.
Ferguson, G. H.
*Fessenden, Chas. V. (Lieut.)
Filteau, J. N. L.
Fleming, G. O. (Lieut.)
*French, W. G.
*Gage, Chas. E. (Lieut.)
*Gagnier, O. J.
Gagnon, A.
*Gagnon, E.
*Geale, C. N.
*Gear, Geo.
*Gilley, J. R.(Lieut.)
*Glanville, J. C.
Glave, R. B.
Goldie, J. E.
*Graham, D. S.
*Grant, W. R.
*Hall, John S.
*Hammer-Schou, J. (Capt.)
*Hayman, L. T. (Lieut.)
*Heeney, Terrence J. C. (Lieut.)
*Hewson, J. H.
*Jacquemart, Rene,
*Jaffary, Jas. H. E.
James, Victor A.
*Jepson, Thos.
*Johnson, G. Alan, (Lieut. M.C.)
Kennedy, Chas. Lawrence
*Knight, A. G. (Capt. D.S.O., M.C.)
Laurin, James E.
Liddy, S. J. Wilford,
*Lindsay, Roy Eli (Lieut.)
Loignon, B.
*Macaulay, Colin A.
*Macheras, Jos. P.
*Macpherson, H.E.
Margison, Oswald,
*Martin, B. E.
McClintock, G. A.
McCulloch, M. J.
McDonald, John Nicholson,
*McInnes, Wm. A.
*McIntosh, W. L.
Methe, L. P.
*Mignault, L.
Morency, Geo. Elie
Murphy, A. E.
*Murray, Jas.
Noonan, Wm. H.
*Patterson, R. G.
*Pearse, W. G.
*Peterkin, S. MacC.
*Plant, W. A.
Potter, John B.
*Pym, J. S.
Ricard, Maurice,
*Richardson, C. W. B. (Lieut.)
*Ritchie, W. W.
*Ryan, Chas. C.
*Scott, M. A. (Lieut.)
*Scott, N. M.
*Seymour, E. R. W.
*Shannon, R. E.
Sharpe, C. B.
*Sime, A. W.
*Spear, D. C.
*Spence, W. A.
Stalker, D. A.
*Staples, G. J.
*Stewart, A. E.
Stokes, L. F.
*Sutherland, D. M. (Lieut.)
*Voaden, Vincent,
*Williscroft, Geo. M.
*Wilson, A. L.
*Wilson, J. C.
*Wood, H. A. (Lieut.)
*Woollatt, D. H. (Lieut. R.A.F.)
Yates, B. T.

Associates

Gosselin, Jos.
McGuire, F. C.

The American Association for the Advancement of Science

In the November Journal, an announcement was made of the Toronto meeting of the American Association for the Advancement of Science, to be held December 27-31 in the buildings of the University of Toronto. Some thirty associated or affiliated societies have written announcing their intention of holding sectional meetings at this Toronto Conference, and will take part in the general meetings, receptions and social events. The attendance will probably be from one thousand to two thousand, including scientists representing the different universities in the United States and Canada, and also representatives of Government Departments, industrial and other establishments employing scientific staffs.

It is the intention of the local committee to have, as an integral part of the conference, an exhibit of scientific apparatus and products, chiefly of Physics and Chemistry. There will also be a display of the most recent scientific books. The chairman of the local committee for the Toronto meeting is Dr. J. C. Fields, professor of mathematics at the University of Toronto and well known in scientific circles. On the local committee there are a number of engineers, Brigadier General C. H. Mitchell, M.E.I.C., and Professors J. W. Bain and C. H. C. Wright, Faculty of Applied Science.

In the announcements of last month the names of engineers connected with the engineering section were given. Professor C. R. Young, M.E.I.C., is a local representative of the Society for the Promotion of Engineering Education. As announced some time ago H. L. Seymour, C.E., (Tor.) A.M.E.I.C., is the secretary of the Local Committee. On account of the great amount of work involved he is being assisted by A. M. Reid, S.E.I.C. who has taken an active interest and a prominent part in *The Institute* in connection with student activities. He is at present Chairman of the "School" Committee of the E.I.C., formed to co-operate with the executive of the Toronto Branch.

Library Notes

"The New Oil Fields of Northern Canada" by F.H.Kitto, A.M.E.I.C., is the title of an interesting pamphlet on the Mackenzie District that has recently been issued by the Department of the Interior through its Natural Resources Intelligence Branch at Ottawa. The report contains a description of the area of the new district, a resumé of progress and development, a synopsis of the regulations and other valuable information regarding routes of transportation, communication, climate, sources of supply, accommodation and such details.

A route map of the district accompanies the pamphlet which may be obtained free of charge, upon application to the superintendent of the natural resources, Intelligence Branch, Department of the Interior, Ottawa.

American Society for Testing Materials, 1921 Tentative Standards. 518 pages, $5 paper binding, $6 cloth binding, published by American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa. This volume brings up to date the Standards and Tentative Standards of the A.S.T.M. and is a valuable addition to the engineer's library. The Standards cover: ferrous metals, non-ferrous metals, cement, lime, gypsum and clay products, preservative coatings, petroleum products, road materials, coal, waterproofing, insulating, shipping containers, rubber products, and textile materials.

Members' Exchange

For Sale

Jacob staff instrument without staff, can be inspected at Institute Headquarters office.

PERSONALS

H. R. Theakton, Jr.E.I.C., lately with Stone and Webster, in Boston, has been appointed assistant professor of engineering at Dalhousie University, Halifax, Ont.

John A. Denoran, A.M.E.I.C,, has accepted a position with the engineering department of the Hollinger Gold Mines, Ltd., at Timmins, Ont.

Herbert Phillips, M.E.I.C., has been appointed managing director of The New Brunswick Contracting and Building Co. Ltd., with Headquarters at 107 Prince William St., St. John, N.B.

C. Wilbert Ryan, Jr.E.I.C., formerly of Wolfville, N.S., has moved to Patterson, N.J., where he is employed by the John W. Ferguson Co.

R. K. Northey, A.M.E.I.C., has moved from Regina, Sask, to Toronto, Ont. where he has joined the staff of the Tulfer Manufacturing Company.

George Sproule, M.E.I.C., who has been for some time in County Tyrone, Ireland, is sailing for the Gold Coast Colony, Mr. Sproule has been appointed an assistant engineer on the Gold Coast Colonial Government Railway.

Rolph Allingham, Jr.E.I.C., has accepted an appointment with A. W. Mankins, engineers and contractors, and has sailed for South Africa, to take up his duties in the Durban office of the company.

A. J. Riddell, A.M.E.I.C., has severed his connection with the Trussed Concrete Company of Canada Ltd., and has become associated with Gilbert J. P. Jacques, architect, of Windsor, Ont. Mr. Riddell will be in charge of engineering and construction work for the partnership.

Walter K. Scott, A.M.E.I.C., has resigned from the firm of McGregor and McIntyre, Toronto, to join the staff of the Phoenix Bridge and Iron Works Limited of which E. S. Mattice, M.E.I.C., was recently appointed managing director.

C. G. R. Armstrong, E.I.C., has left the Brumner Mond Company at Amherstburg, Ont., where he was assistant construction superintendent for the past year to take the appointment of demonstrator in the Department of Drawing, University of Toronto.

Julian C. Smith, M.E.I.C., will supervise the construction of the Manitoba Power Company's hydro-electric development. Mr. Smith is vice-president and general manager of the Shawinigan Water and Power Company and has been for many years one of the most prominent figures in the electrical industry of the Dominion.

Brig.-Gen. C. J. Armstrong, C.M.G., C.B., M.E.I.C., officer commanding Montreal Division, who was in charge of the ceremony of unveiling the cenotaph on Dominion Square, Montreal, on Armistice Day in honour of "The Glorious Dead", laid a wreath at the foot of the cenotaph at the request of the President and Council of *The Institute* in memory of the eighty-eight members of *The Institute* who died on active service and in honour of the thousand members who saw active service.

R. de L. French, M.E.I.C., recently appointed professor of highway and municipal engineering, McGill University has announced that he will accept a limited number or of consulting engagements in connection with water supply and sewerage systems, roads and pavement and reinforced concrete structures. Mr. French read a paper on Western lignite before the Society of Chemical Industry in Montreal on November 18th.

G. L. Stephens, A.M.E.I.C., engineer lieutenant, R. C.N. has been appointed to take charge of engineering instruction in the Royal Naval College of Canada, Esquimalt, B.C.

F. J. Bell, M.E.I.C., has resigned as president and general manager of Canada Wire and Cable Company, Toronto, manufacturers of electrical wires and cables; he has also resigned as president and general manager of Leaside Engineering Company which corporation controls the Canada Wire and Cable Company and other firms. Before Mr. Bell joined the Canada Wire and Cable Company, he was general manager and secretary of the British Canadian Power Company, supplying power and compressed air to the Cobalt district of the Northern Ontario mine field.

Capt. H. W. B. Swabey, M.E.I.C., whose work in connection with the munitions programme in Canada is well known recently was honoured by the publication of his paper on "The Manufacture of Munitions in Canad" in the Proceedings of the Iron and Steel Institute of Great Britain, the paper being read at the meeting of the Institute held in Paris on September 5th. Captain Swabey's paper was originally read before Ottawa Branch in May 1919, but was revised to some extent before being presented to the Iron and Steel Institute, the work of revision being done in collaboration with R. Genders of the Research Department of the Woolwich Arsenal. A limited number of reprints of the article are obtainable on application direct to Capt. Swabey at 254 Old Orchard Ave., Montreal.

Geo. F. Porter, L.L.D., M.E.I.C.

Geo. F. Porter, L.L.D., M.E.I.C., who was one of the engineers upon whom McGill University conferred the honorary degree of Doctor of Laws at the recent Centenary Convocation has had an interesting career, having reached his present eminent position in the engineering world after much hard work and steady effort. Dr. Porter was born in Detroit in 1862 and after education in the city public schools was employed by Mason L. Brown, a Detroit civil engineer with whom he remained from 1885 to 1894 when he joined the staff of the Detroit Bridge and Iron Works. Leaving this company in 1896 Dr. Porter was for two years in Pittsburgh, but returned to the Detroit Bridge Works and in 1897 was in touch with the construction of the Victoria Jubilee Bridge at Montreal.

GEO. F. PORTER, L.L.D., M.E.I.C.

In 1900 the Canadian Bridge Company, Limited was founded at Walkerville, Ont., and Dr .Porter was in charge of the draughting department of the new company from its foundation until January 1909. During this period Dr. Porter was interested in the design and construction of a number of important bridges including the Lethbridge viaduct of the Canadian Pacific Railway. In 1909 he was appointed a member of the board of engineers in charge of the design of the Quebec Bridge intended to replace that which failed in 1907. During the detail work of the design Dr. Porter was in charge of the draughting department and on completion of the design he was appointed by the Canadian and Dominion Bridge Companies to work out details and prepare a competitive design. This tender with some modifications was accepted and Dr. Porter was then appointed engineer of construction for the St. Lawrence Bridge Company, a new company which was formed to combine the interests of the Canadian and Dominion Bridge Companies in the work of erecting the Quebec Bridge. The bridge was successfully completed in August 1918, and to Dr. Porter is due no small amount of the credit for the design and erection of this monument to Canadian enterprise.

Dr. Porter has been an active member of *The Engineering Institute* since his election as Member in 1909. The esteem in which he is held by the members of the Border Cities Branch is well shown by the resolution which was passed at the meeting of the Branch held on October 14th., conveying hearty congratulations to Dr. Porter on the occasion of the conferring of this signal honour by McGill University.

New Rhodes Scholar

The committee of selection for the Province of Quebec has recommended Lawrence Henry Armstrong S.E I C. for the Rhodes Scholarship to Oxford University The value of the scholarship awarded under the Rhodes Trust is three hundred pounds a year for three years with the addition until further notice of an annual bonus of fifty pounds.

L. H. ARMSTRONG, S.E.I.C.

Mr. Armstrong will take up his studies at Oxford in October, 1922. He is the eldest son of Professor Henry F. Armstrong of McGill University. He graduated from the Montreal High School, and after matriculating in 1917, entered McGill as student in the Arts Faculty. On his 18th birthday he was accepted for training in the Royal Air Force, and later entered the naval service as a wireless operator. On demobilization he re-entered McGill in the Faculty of Applied Science, and is now a student in the fourth year of the electrical engineering course leading to the degree of B.Sc.

Mr. Armstrong is 22 years of age. He holds the Canadian Government first class certificate in radiotelegraphy, and during the summer vacations of 1919 and 1920 served on ocean going vessels as chief wireless officer under the Marconi Company. Last summer he was employed by the Canadian Government as a radio electrician at Halifax, Barrington Passage and Chebucto Head direction-finding station. It is understood that he wishes to continue with his studies in the ground-work of wireless science under Professor Townsend and others at Oxford.

BRANCH NEWS

Vancouver Branch

J. N. Anderson, A.M.E.I.C., Secretary-Treasurer.

Ballantyne Pier

A general meeting of the Vancouver Branch was held in the Board of Trade Auditorium, on Wednesday 26th October. Major G. A. Walkem, M.E.I.C., was in the chair, and over sixty members and friends were present.

Papers describing the recent visit to the Ballantyne Pier were read by E. H. James, A.M.E.I.C., resident engineer for A. D. Swan, M.E.I.C., consulting engineer, Montreal and by Wm. Smaill, M.E.I.C., engineer for the contractors, the Northern Construction Company.

The fol owing is a synopsis of the paper by Mr. James, which was fully illustrated by lantern slides.

The Ballantyne Pier, at present under construction is situated on the South side of Burrard Inlet, Vancouver, B.C., immediately West of the Great Northern Railway dock. It is the first unit of a complete scheme for the development of this portion of the harbour. The pier is 1200′ long by 340′ wide, and has four two-storey transit sheds. The two inner berths are dredged to a depth of 35′ below low water, and the two outer ones to 45′ below low water. The entire pier, including sheds, is being constructed in reinforced concrete. The foundations consist of cylinders sunk through a centre fill to hold foundation. Before this type of pier was decided upon, preliminary designs and estimates were made for several other types, including reinforced concrete cribs, reinforced concrete piles and gravity quay walls. The design at present being constructed was found to be the most economical. The shore gradually sloped from low water at the inner end of the pier to about 100 feet below low water at the outer end. This necessitated quite a lot of dredging and the contract for this has just been completed. The pier deck is laid so that the floor of the sheds rises toward the back at a slight grade, so that it is level with the floors of the cars. Between the sheds the deck has a fall to the back, so that passage for traffic over the railway tracks is provided without the necessity of having temporary bridges, as is usual over a depressed track. The sheds will have continuous sliding doors at the front and back, and will be provided with travelling cranes in front to handle cargo from the ships to the sheds.

For handling cargo inside the sheds, elevators, chutes, etc., are being provided. Full provision is being made for fire protections and a complete system of sprinklers is to be installed.

Synopsis of paper by Mr. Smaill:—

Following Mr. James, Mr. Smaill gave a description of the construction of the above up to the present. A very complete set of lantern slides was shown giving every part of the contractors' operations at North Vancouver where all the precast units for the work are being cast. These units consist of the cylinder sections varying in length from 3′ to 17′ 6″; trusses; sheet piles; bearing piles, and beams, all in reinforced concrete. As some of these units weigh close to 25 tons, the handling of these requires considerable care. Particular description was given of the tamping of the cylinder sections, by hammering the outside of the steel forms with pneumatic hammers; and curing the cylinders by steam so as to enable the forms to be stripped quickly. Mr. Smaill then went on to describe the work of cylinder sinking going on at the site of the pier. Many interesting slides were shown of the method of handling the long cylinders into position, and the special appliances which had to be designed for this work.

Following the reading of the papers, A. D. Swan, M.E.I.C., consulting engineer for the project, made a few remarks in which he paid high compliment to the manner in which the work was being carried out.

Local News

A. G. Graham, A.M.E.I.C., left Vancouver on 7th November for London, England, en route to the Gold Coast, where he will join the engineering staff of Brigadier-General J. W. Stewart, who has an important contract for the Imperial Government.

Some time ago A. D. Swan, M.E.I.C., presented the sum of twenty-five dollars to the Vancouver Branch to provide a book prize for an essay on "Town Planning in relation to Vancouver".

This competition is open only to Student Members of *The Institute* belonging to the Vancouver Branch, and essays are to be in the hands of the Branch secretary by 1st February, 1922.

Calgary Branch

Arthur. L. Ford, M.E.I.C., Secretary-Treasurer.

Floyd K. Beach, A.M.E.I.C. Branch News Editor.

That the scientific jargon of the engineer conceals valuable public information from the newspaper reading public was one of the lessons brought to the local Branch of *The Engineering Institute of Canada* in a well delivered and carefully prepared talk by Charles O. Smith, on Friday, November 18th. On certain occasions when in the press gallery at Ottawa, Mr. Smith went to deputy ministers for information and more often than not he found great quantities of just the information he wanted in blue books brought up from he basement. And the information, exact and complete in all cases, was usually clothed in such words as to be unintelligible to the average man. It might almost as well have been written in a foreign language.

News of the natural resources of this country is of interest to more than a mere average reader of the daily newspaper. It is safe to say that a large percentage of the readers would read every word of an article dealing with our natural resources and prepared by an engineer who makes it his business to know his facts, if only he would translate them into the language of the people. If he is unable himself to do so, the editorial staffs of the newspapers stand ready to collaborate with him.

Mr. Smith in opening his talk outlined the various general departments of a modern paper, grouping them under news and editorial, mechanical, and advertising. Under the first heading comes first of all the editor, who is responsible for the policies that are to govern the local news, and to some extent the form to be given the telegraphic news. Then there is quite a staff who take the telegraphic news from the flimsy of the telegraph operator and see it all the way to type. The news editor and his staff who gather local news and not only get it into their own paper, but transmit such part of it as is of more general interest through the channels of the Canadian Associated Press and that of the United States.

The modern paper is very dependent on the modern machinery of the press room, the linotype machine, stereotyping facilities, photo engraving and the high speed press. It is most interesting to follow the little lines of type from the linotype machine to the press. When one sees the way they are handled, one does not wonder that they sometimes get mixed. Here Mr. Smith told of how he wrote up a sob story one day about an old man whom he had met. The old man was on his uppers and wanted the price of a ticket home. When the story was printed a few lines of it got mixed into the society column and the readers were startled to note that, "Mrs. Smith-Jones is planning to visit Chicago and is terribly needy, having hardly a whole garment. If some kind person will provide a ticket home she plans to return in the fall." Within an hour of publication an infuriated Mr. Smith-Jones had to be placated and it was only by taking him into the press room to see the way things are handled that he could be persuaded that a personal insult had not been intended.

Cuts are well worth their cost. One notable publicity man sometimes intersperses a long article with such a feature as a picture of an elephant lifting a cripple to a street car. Then boldly he informs the reader that having gained his attention by means of the picture. he will tell his story which has nothing to do with the picture. The moral is that a good and striking cut having little bearing on the subject matter is better than no cut at all.

Mr. Smith finished his talk by urging the engineers who of all our citizens are best fitted to make known our natural resources, to make a point of telling the public more and in such a way as to be readable.

Local News

Lt. Col. Wm. P. Anderson, C.M.G., charter member and past president of *The Institute* was present at the meeting and in response to a request from B.L. Thorne, M.E.I.C. Chairman, he spoke very ably on *Institute* affairs, and particularly on the work of the Branches. Col. Anderson was not so sure that there are any engineers who are good enough judges of the general vocabulary of the public to enable them to write popular science. He felt that one must needs call in a newspaper man trained to the job in order to make a success of publicity.

Edmonton Branch

R. H. Douglas, A.M.E.I.C., Secretary-Treasurer.

The meeting for the election of officers for the year 1921-22, took place on August 26th, 1921.

The following were elected:—

Cha rman, (Acclamation)	C.A. Robb, A.M.E.I.C.
Vice-Chairman	Lieut.Col. J G. Reid, M.E.I.C.
Sec.-Treasurer	R. H. Douglas, A.M.E.I.C.
Executive	H. H. Tripp, A.M.E.I.C.
	R. W. Jones, M.E.I.C.
	C. F. Corbett. A.M.E.I.C.
	A. G. Stewart. A.M.E.I.C.
Ex-Officio	D. J. Stewart. A.M.E.I.C.

Winnipeg Branch

Geo. L. Guy, M.E.I.C., Secretary-Treasurer.

At the regular meeting of the Branch held on 3rd. November, Professor Fetherstonhaugh in the Chair, Professor Lodge of the Manitoba University gave an address on "The Ethics of the Engineering Profession".

Professor Lodge traced the development of ethics from its inception and dwelt upon the different codes of ethics which had been from time to time formulated in the history of mankind. After discussing the reasons which had caused these codes to be evolved, he dwelt particularly upon the different professional codes which had from time to time been evolved for the protection of the different professions and went into details of their economic aspects and the relation of the requirements called for in these codes to the general public good. He also criticised constructively and otherwise the suggested code of ethics drawn up by the Association of Professional Engineers of the Province of Manitoba. Professor Lodge's lecture was extremely interesting and the delightful flashes of humour which the speaker introduced into this lecture were appreciated by all present.

A fair discussion took place at the close of the lecture and many interesting points were brought out, particularly those bearing upon the relation between the engineer and the general public.

Local News

G. R. Pratt, A.M.E.I.C., has been appointed fuel engineer for the Alberta Government and has resigned his position with the Canadian Pacific Railway.

J. Rocchetti, M.E.I.C., of the Manitoba Power Commission, who recently suffered a serious automobile accident, has now practically recovered and back again at his office.

Sault Ste. Marie Branch

F. Theo. Gnaedinger, Jr.E.I.C., Secretary-Treasurer.

The first of the season's meetings was held on Friday evening, September the twenty-ninth in the Algoma Steel Corporation Board Room Cornwall Building. It is expected that this room will be available for our use for the remainder of the season. Several new members were present. Among other items of business which came before the meeting was that of interesting the members of the Branch in a Town Planning movement. It was decided to secure information on this matter and to present it at a meeting of the Branch to be held some time during the winter.

Algoma Central Railway

R. S. McCormick, M.E.I.C., gave the Branch a very interesting account of "The Construction of the Algoma Central Railway", illustrating his talk with maps and a condensed profile of the line. In his opening remarks he alluded to the power which, at one time, had been exerted by "promoters" in control of great projects. However, one of the lessons taught by experience, the one which stands forth most prominently in our vast industrial growth, on this continent at least, is that of the folly of capital entrusting to anyone, other than a professional engineer or to those men who have the qualifications necessary for the wise selection of competent professional engineers as advisers, the power to advise upon and direct vast expenditures for the purpose of creating and managing a "big business" of any sort, especially a railroad.

The Algoma Central Railway was promoted by E. H. Clergue; Faith, Hope and Charity as he was called at that time. In many ways wonderful, he was a man of vision, a dreamer of great dreams, possessed of initiative and energy, strong of will and agressive in the face of opposition. His choice of advisers was not always fortunate and in this particular instance the ability and qualifications of those upon whom he relied for advice, the few with whom he consulted, were not such as to guarantee success from the start.

It is generally conceded that the Algoma Central was not correctly located in the beginning, and that the major portion of the line suffered in consequence. The promoter insisted upon the line starting and continuing in a certain way without ever having a reconnaissance survey made to establish a general route. This ill-judged scheme brought the line too near Lake Superior and forced it with heavy grades and curves to cross the many ridges and rivers that lay in its Northbound right-of-way. The contractors, too, were waiting to begin construction work as soon as the stakes were in. Once the start was made, the location parties were bound to push on Northward as fast as possible so as to keep ahead of the construction gangs. Their work was handled as skillfully as could be desired under the circumstances forced upon the locating engineer by the promoter.

The date of organization of the Algoma Central Railway was August 11th. 1899 under Dominion Statute Act of Parliament, 62-63 Victoria, Chapter 50. A later Act, 1 Edward VII, Chapter 46 of 1901, changed the name of the Algoma Central and Hudson's Bay Railway. Subsidies of $6,400.00 per mile and a Land Grant from the Provincial Government were obtained. The latter totalled about two million acres, of which one and one-half million were South and one-half million approximately North of the Canadian Pacific Railway. The line was to run northwards from Sault Ste. Marie to that railway and it was also proposed to extend it as far as Hudson's Bay. As constructed the line now is 195 miles from Sault Ste. Marie to Franz on the C.P.R., and 295 miles to Hearst on the Transcontinental.

Mr. McCormick's first connection with the A.C.R. began with his arrival in the Sault in February 1900. The Sault was then a very different place to what it is now. Location work was already under way. One of his first duties was to set the first slope stakes and cross-section the first cut on the railway, the start being made one morning in February 1900. It was not until December 1912 that train service was opened through from the Sault to Franz on the C.P.R. The second section of the line running to Hearst was surveyed and construction work started in the fall of 1911. Track was laid to Hearst in the Fall of 1913 and train service established one year later.

A condensed profile and a map of the line were exhibited. Mr. McCormick pointed out the salient features of the line, enlarging on the difficulties which had been surmounted by the engineers and describing the methods adopted by them. The Bellevue and Montreal River bridges were described and a short account given of the Montreal River section of the line. The Algoma Central follows the Montreal River for twenty-two miles, crossing it nine times and rising 185 feet in that distance.

The construction work was briefly outlined. Many reminiscences of engineers and contractors engaged upon this work added spice to this interesting and instructive talk. In concluding his account of the construction of the Algoma Central Railway the speaker referred to the reconnaissance surveys which were made for the line from Franz to Hearst and the better profile which has resulted.

Town Planning

At the regular monthly meeting of the Branch, held on Friday evening October 28th, a Committee of Town Planning was appointed to look into the matter of promoting a Town Planning scheme for the Sault and to have a paper prepared and read before the Branch on the principles of Town Planning. This committee at present consists of Messrs, J. W. LeB. Ross, K. G. Ross. Wm. Seymour and F. T. Gnaedinger, and has the power to add to its numbers as it deems necessary.

Handling Raw Materials in a Steel Plant

Carl Stenbol, M.E.I.C., superintendent of maintenance of the Algoma Steel Corporation read an extremely interesting paper on the "Handling of Raw Materials in a Steel Plant". He gave a detailed account of the development of the Algoma Buckets for handling ore and coal from the boats to stock piles and to bins. The operation of the coal bucket was demonstrated with a model.

These buckets are of the grab type and were developed after much experimenting and designing carried out under Mr. Stenbol's supervision. The first Algoma Bucket placed in service weighed 4 per cent. less than the type of bucket it replaced. In handling ore it picked up 9 per cent. more ore from the stock piles and 32 per cent. more from the boats than the other bucket. These resul's gave full confidence in the excellence of the design and a contract was placed with a manufacturer for the delivery of two of the improved type in the Spring of 1920. The buckets were not delivered on time, and it was only possible to place one in service after navigation closed last year. The work done by the Blaw-Algoma bucket showed an average increased capacity of the ore-bridge on which it was installed of 30 per cent. and the up-keep was practically nil over a period of ten months. The ore unloading started late this season and consequently there has been only a couple of months trial made of the bucket, but during this time it has been responsible for an increase of at least 50 per cent. in the capacity of the bridge on which it was installed.

A short description of the methods and facilities for coal and ore handling on the Algoma Steel Corporation's docks was prefaced by some general remarks on the value of experience and study in solving problems of the transportation of materials. These problems confront engineers wherever they turn and it is not necessarily the latest thing in mechanical devices that will always solve them. There is sometimes a place for simpler or old-fashioned methods. The principal end in view is to obtain a minimum cost per unit of quantity of material handled over a period of time which in some cases may run into years.

Border Cities Branch

J. E. Porter, A.M.E.I.C., Secretary-Treasurer.

The postponed regular November meeting of the Branch was held in the Cadillac Cafe on Thursday evening, November 17th, 1921, with twenty-three members present. Dinner was served at 7.00 p.m. following which the regular business of meeting was dealt with.

O. M. Perry, M.E.I.C., manager Windsor Hydro Electric System, speaker of the evening, gave the attendant members one of the best addresses in the history of the Branch, on Hydro. The speaker traced the development of Hydro, showing the growth in recent years. He also dealt with the Chippawa Development. By aid of charts, for the Border Cities, Mr. Perry conveyed in a readily understandable manner, the time and the cause of peak loads, the rate of increase in consumption yearly, the annual revenue and annual expense per consumer, showing a surplus in past years which surplus is now being used to reduce the rate to the consumers. He also explained reasons for shop supplies not being sold to users at cost price, stating that this department was conducted in fairness to other private electrical shops.

Mr. Perry showed that Hydro was not as economical for general heating purposes as coal, but that for motive power, Hydro had the real advantage. A comparison was drawn between the cost of electricity to consumers in 1920 as compared to the costs of rates in Windsor in force previous to the coming of Hydro. In 1920, 11,567, 534 k.w. hrs. were sold which at Hydro rates amounted to $348,144.00. At rates charged by the private company in 1913, this would have amounted to $689,359.22 or $341, 215.19 more. At the same time this latter sum was saved to the consumers, the year's operation showed a net surplus of $80,800.82 which has been given back to the people in a reduction of rates this year. The total saving in 1920 was, therefore, $422,016.01 and as the people had invested in the system by debenture sales, the sum of $690,000.00, the consumers in the year 1920, received a cash dividend of 61%.

Some little time was then taken in discussion. The speaker was then moved a very hearty vote of thanks by W. J. Fletcher, A.M.E.I.C. seconded by R. J. Demarais, on behalf of the members.

Arrangements were then made to pay a visit of inspection to the Canadian Steel Corporation, Ojibway Plant, on November 26th.

J. J. Newman, M.E.I.C. moved the following resolution (prepared by H. Thorne, M.E.I.C. who was unavoidably absent.)

"Whereas,—The proposal to extend ocean steamship service to the Great Lakes, through the improvement of our International Water Ways, has become a probability rather than a possibility.

And Whereas,—This deepening of our water-ways will bring a new range of opportunity to our very doors.

And Whereas,—The Border Cities Star has mentioned a proposal to develop the river front of The Border Cities through a Board of Harbour Commissioners.

And Whereas,—This proposed water front development is of special interest to engineers, both as citizens and as engineers.

Be it resolved by The Border Cities Branch of *The Engineering Institute of Canada*:

First,—That we do fully endorse the movement to establish a Harbour Commission to have complete jurisdiction over our water front development throughout its entire length.

Second;—That we do strongly urge upon those entrusted with the constitution of this Harbour Commission, that the members of the Commission be selected and the work carried out and maintained to the greatest advantage of the greatest number, and completely independent of political or party influence whether municipal, provincial or federal looking ahead to the larger development when the several municipalities shall have merged into one large city, the Ocean Port of Western Ontario.

Third,—That a copy of this resolution be sent to each of the following:

Canadian Deep Waterways Association.
Councils of Cities and Municipalities Concerned,
Border Chamber of Commerce."

This was seconded by L. B. Tillson, A.M.E.I.C. and carried unanimously

Niagara Peninsula Branch

Rex P. Johnson, A.M.E.I.C., Secretary-Treasurer.

G. R. Taylor, A.M.E.I.C., Branch News Editor.

On Saturday afternoon, October 2nd, an interesting trip was made by about thirty members of the Branch to three of the largest industrial works at Welland. The first plant visited was that of the Page Hersey Tubes Ltd. where steel pipe was seen in the process of manufacture. The furnaces and special machinery for rolling, welding and finishing pipe of all sizes was watched with great interest. The second plant inspected was that of the Canada Foundries & Forgings where heavy forgings are made with equipment of very large capacity. Another works visited was that of the Canadian Billings & Spencer Co., to see the manufacture of all sorts of small forgings such as tools and automobile parts.

The trip proved of great interest and the Branch members felt that they had gathered a fund of worth while information.

Halifax Ocean Terminals

On November the 9th, a dinner meeting was held at the Welland Hotel, St. Catharines with N. R. Gibson A.M.E.I.C., in the chair. About 75 members were present and after as enjoyable a dinner as these dry days can provide, a dinner enlivened with songs and music, the meeting settled down to the business of the evening, which was to hear A. C. Brown, A.M.E.I.C., give an illustrated address on "The Halifax Ocean Terminals". Mr Brown, who is at present chief engineer for J. P. Porter, Standifer & Porter Bros., contractors on the Welland Canal was on the Halifax Ocean Terminal work for some years.

Mr. Brown pointed out the importance of Halifax in the commercial development of Canada and of the Empire. Its position in the North Atlantic Trade Route, its fine natural harbour of sufficient size and draught to accommodate the largest vessels, its easy navigation and small tidal variation mark it as a logical port for development. For some years the Dominion Government have contemplated increasing the railway and dock facilities and investigations were commenced in 1912 with a view to ascertaining the best scheme. Four schemes were considered, and that finally chosen called for a landing stage 2060 feet long, five freight piers, each 1250 feet long and a breakwater, together with railway connections, yards and terminal station. The work was commenced in April 1913 and although the original programme was modified by the war, the work completed to date, consists of the landing stage, one freight pier, the breakwater and a certain proportion of the railway and yards. The sea walls were built of cellular reinforced concrete blocks, faced from below low-water with granite quarried in the vicinity of the work. If the rock was less than 45 feet below the water surface the block sat directly on the rock which was brought level with concrete pedestals, if between 45 and 55 on a mass concrete footing on the rock, while at greater depths the concrete footing rested on a rubble fill. The blocks were lowered from a railway crane travelling outwards on those already laid, no falsework being used. A diving bell was used in placing the concrete pedestals and found very satisfactory. The sub-aqueous mass concrete was deposited very wet and levelled off by a diver. In cleaning the rock a dipper dredge was used, having a 13 yard bucket in soft material and an 8 yd., bucket in harder material. The railway work, which includes freight yards at Bedford Basin as well as yards at the terminals themselves, also includes 5½ miles of double track with provision made for four tracks at some future date. A 60 foot railway cutting was involved and owing to the variable character of the material presented considerable difficulties. Many of the drill holes had to be cased preparatory to loading. Both steam and electric drills were used and in drilling through a series of strata offering differing resistances the electric drill was found more satisfactory. The material from the cut was disposed of in Bedford Basin and the made ground utilized for the freight yards. The building of the railway involved the construction of fourteen highway and two railway bridges, and when complete the entire scheme will cover a land area of 215 acres and a water area of 62 acres, with a water front of slightly over a mile.

The lecture throughout was illustrated with slides, which added greatly to its interest.

A hearty vote of thanks was accorded to Mr. Brown

London Branch

George C. Wright, A.M.E.I.C., Secretary-Treasurer.

The London Branch of *The Engineering Institute of Canada* was organized on Nov. 16th, with nearly 40 members from London, Middlesex County, St. Thomas and Woodstock. J. Davis Barnett, librarian of Western University and charter member of the Canadian Society of Civil Engineers, was chosen honorary chairman by a unanimous standing vote amidst continued applause. H. A. Brazier, A.M.E.I.C., city engineer of London, was chosen chairman of the local Branch until the expiration of the calendar year. W. J. Forbes-Mitchell, A.M.E.I.C., was elected vice-chairman, George C. Wright, A.M.E.I.C., secretary-treasurer, and F. A. Bell. A.M.E.I.C., city engineer of St. Thomas; F. J. Ure, A.M.E.I.C., city engineer of Woodstock; A. H. Smith, M.E.I.C. Lieut.-Col. E. I. Leonard, A.M.E.I.C., of London; W. C. Miller, Jr.E.I.C., of St. Thomas, and A. H. Smith, A.M.E.I.C., of the department of public works were elected to the local branch council. All elections were unanimous, and the officers will serve until the expiration of the calendar year.

Monthly Meeting

The local Branch decided to hold monthly meetings on the third Wednesday of each month, at which technical papers will be read and questions of policy decided. The social feature of the organization will also be emphasized as well as upholding a high ideal of public service. Applications of some 15 junior members were received at the meeting and will be dealt with at once. The senior members number 25, and it is expected that the London district Branch will become within a short while one of the most powerful organizations in Western Ontario, and able to take rank with the oldest Branch of *The Engineering Institute* in Canada.

The Barnett Library and other Western University library facilities were tendered the newly formed Branch and the offer was gratefully accepted.

Fraser S. Keith, in opening his address, stated that he did not expect to see so many engineers present and that he was assured that the Branch would be a brilliant success. "This is the baby Branch of the organization but you are not going to be the smallest. This will be one of the most influential Branches in Canada," he said.

There are now Branches of *The Institute* from Sydney to Victoria and the Branches are composed of more than 5,000 members, five years ago there were very few in the East and now there are Branches in every place of any size.

The objects of *The Institute*, as outlined by Mr. Keith are: "To facilitate the aquaintance and interchange of professional knowledge among its members, to promote their professional interests, to encourage original research, to develop and maintain high standards in the engineering profession, and to enhance the usefulness of the profession to the public".

Mr. Keith urged that the members fall in line with other clubs and do a public service. He explainied that this was one of the objects of *The Institute*.

In referring to the meetings, Mr. Keith stated that there must be a social atmosphere along with the discussion of technical subjects. To hold the interest of the younger members, this was absolutely necessary. The social atmosphere has now been introduced into all the Branches.

Speaking of the manner in which *The Institute* was growing, he said that where there was one active member five years ago there are now 20.

"It has been proposed that a new code of ethics be brought in; as soon as this is done it will place the profession on a higher plane", stated Mr. Keith.

The classification of engineers was another important matter in which he outlined. Ontario has no classification, but at the next session of the provincial house this matter will be brought before them in an attempt to pass a classification bill.

"Many of the members of the profession do not know their proper earning capacity", was the opinion of Mr. Keith, and he cited many instances to corroborate his statement.

The banquet was a success from every point of view. Nearly double the number first expected put in their appearance for the organization meeting. The London district embraces an area of 50 miles in diameter and contains not only the local civil, mechanical, electrical and other engineers, but the staffs of the department of public works office in Western Ontario recently moved to London from Windsor.

The menu cards reached the zenith of originality in being miniature blue prints, engraved and decorated by J. R. Rostrum, A.M.E.I.C. of the city engineer's department, for which he was tendered a vote of thanks.

The toast to the King was proposed by Col. Ibbottson Leonard and the toast to the city of London was made by Hugo B. R. Craig, M.E.I.C., head of the department of public works in Western Ontario. With the toast to the city were coupled the Chamber of Commerce, the County of Middlesex, St. Thomas and the press. Ald. John Bridge replied for the city and the Chamber of Commerce, County Engineer Charles Talbot for Middlesex, F. A. Bell for St. Thomas, and Charles Thomas for the press.

The following engineers attended the banquet: W. C. Miller, Jr.E.I.C., city engineer, St. Thomas; Fred A. Bell, A.M.E.I.C., and G. H. Chalmers, S.E.I.C., civil engineer, St. Thomas; F. J. Ure, A.M.E.I.C., civil engineer, Woodstock; James A. Vance, A.M.E.I.C., contractor, Woodstock; W. G. Ure, civil engineer, Woodstock; J. W. Smith, A.M.E.I.C., department of highways, St. Thomas; Thomas Smith, Montreal; James A. Bell, M.E.I.C., St. Thomas; W. J. Law, St. Thomas; H. F. Armitage, St. Thomas. The remaining are from the city: A. M. Kirkpatrick, A.M.E.I.C., department of public works; A. A. Anderson, Jr.E.I.C., D. P. W.; C. H. Mathewson, A.M.E.I.C., H. E. P. C.; A. H. Morgan; R. W. Angus, M.E.I.C., consulting engineer; Charles Talbot, A.M.E.I.C. county engineer; J. O. Peart, A.M.E.I.C., engineer; P. W. Roy Dale, engineer; Charles Thomas, Free Press; Donald Soper, engineer; J. A. Lanell, D. W. P.; H. J. Bridge, D. W P.; A. W. Hayman, contractor; J. D. Barnett, M.E.I.C., John Bridge, H. A. Brazier, A.M.E.I.C., H. B. R. Craig, M.E.I.C., Ibbotson Leonard, A.M.E.I.C., John Moore, J. M. C. Moore, Jack Mitchell, R. W. Garrett, John R. Rostrom, A.M.E.I.C., E. C. Wood, W. H. Veitch, D. M. Morrison, Wm. A. Mellow, W. O. Cooke, E. A. Gray, R. W. Swayze, E. V. Buchanan, H. H. Armitage, J. E. Wright, F. H. Fairncomb, S.E.I.C., W. J. Forbes-Mitchell, A.M.E.I.C., and A. H. Smith, M.E.I.C.

Hamilton Branch

W. F. McLaren, M.E.I.C., Secretary-Treasurer.

On November 1st, the Hamilton Branch was invited by the Chamber of Commerce to attend a banquet given to the delegates of the Canadian Deep Waterways and Power Association, meeting here. W. R. Drynan, president of the Chamber of Commerce, occupied the Chair.

During the dinner, popular songs were sung by the guests, lead by Bruce Carey. After the toast to the King and the President of the United States, O. E. Fleming, president of the Association, was introduced. He said the great importance of the proposed St. Lawrence Deep Waterways System, was not fully appreciated. It would serve two needs, transportation and power. Ocean going boats would be able to reach the heart of the continent at an expense of 250 or 300 million dollars. It was approved by engineers on both sides of the line. There was 1,460,000 H.P. going to waste, which would be available for sale at a price to be self supporting.

He then introduced Henry I. Harriman, of Boston, president of the New England Power Co., who very strongly favoured the scheme. He said the trade of the continent flows East and West while the rivers flow North and South except the St. Lawrence which broke the Appalachian mountains to the sea and opened up an inland water course of 2000 miles. There were two obstacles in the way, Niagará Falls and the Rapids of the St. Lawrence. The first would be overcome by the new Welland Canal. The Rapids of the St. Lawrence between Lake Ontario and Montreal, a distance of 188 miles, may be divided into three sections.

(1) International, to the foot of the Long Sault.
(2) Lakes St. Louis and St. Francis.
(3) Lachine Rapids at Montreal.

Each has a rapid.—There is a drop of 90 ft. to the foot of the Long Sault. A complete project has been worked up. A dam at the foot of the Long Sault would raise the water 75 ft. or another 10 ft. if required. A dam at Ogden's Island would be built for safety and to level out the upper rapids. These make open river navigation for 113 miles from Lake Ontario to Lake St. Francis. No work would be required in the second section. Below Lake St. Francis, go by canal and then through Lake St. Louis. Third Section.—Lachine,—Canal on North side of river. Dams might have been built for lower rapids but canals are cheaper, although they wipe out possibility of power. Cost estimated at $252,000,000 including development of 1,500,000 H.P. at Cornwall, half to United States and half to Canada. Power house would be on border.

In the 188 miles from Montreal to the Lakes there would be only 27 miles of canal with 9 locks. Balance of navigation would be in the broad river. Considering the economy of the project, 1,500,000 H.P. = 10,000,000-000 K.W. hrs. per year. Allowing 6% interest and 1% sinking fund on $250,000,000 = $17,500,000 add $2,500,000 for operating expenses, total $20,000,000. Therefore, a charge of 2 mils per K.W. hr. at the switchboard would pay for the whole development in 35 years. 1 mil per K.W. hr. would pay for the power development, which would cost $100,000,000 while the cost without power development would be $150,000,000.

Mr. Harriman said that it would be a crime to let this power go to waste and that Montreal, New York and Boston could not stop it for their selfish interests. He then went on to show that if the railroads in New England, where coal costs $8.00 per ton, were electrified, they would pay for electrification in 3 or 4 years at 1 cent per K.W. hr. and then save 2½% on the capital stock. The cost of manufactures in the cotton mills would be greatly reduced and the cost of bringing in wheat from the West to Boston reduced from 14c. per bushel to 7c. per bushel. He said that Montreal was closed by ice 4 or 5 months in the year and that Boston was the natural outlet in the winter.

One of the arguments against the scheme was the high cost, which is only equal to 5 dreadnoughts, and New York alone is spending more on her harbour improvements. As to the railroads, it will not hurt them, for they will get all the finer class of freight on which they make most of their profit and only lose the rough freight. What is good for the whole country he thought would also prove good for Buffalo, Montreal and Boston.

Major A. C. Lewis, secretary-treasurer of the Association, then introduced Congressman A. W. Jefferies of Nebraska, who made an eloquent speech, saying that the west would be greatly benefited by reduced transportation rates.

After votes of thanks the meeting closed with the singing of "O, Canada".

Toronto Branch

F. B. Goedike, M.E.I.C., Secretary-Treasurer.

C. R. Young, M.E.I.C., Branch News Editor.

Water-proofing of Roadway Surfaces

On October 20th a valuable discussion on the subject of "Water-proofing of Roadway Surfaces" was conducted at the Toronto Branch. The subject was introduced by G. G. Powell, M.E.I.C., deputy city engineer of Toronto, and followed up by E. M. Proctor, A.M.E.I.C., of James Proctor and Redfern Toronto, L. M. Jones, M.E.I.C., of the Warren Bituminous Paving Co., Ltd., and A. E. Jupp, A.M.E.I.C., of the Jupp Construction Co., Ltd.

Mr. Powell stated that for many years an effort had been made by roadway engineers to develop a waterproof pavement of a durable character which would not be prohibitive in cost. While sectional pavements such as brick, granite sets and asphalt block were very satisfactory at the outset, the grouting often failed before very long and had to be replaced by bituminous material. In Toronto, the sectional type of pavement is now only used on grades in excess of 5%.

Several million square yards of asphalt pavements have been laid in Toronto, said Mr. Powell, and have proved very satisfactory, some of them having been in service for seventeen years. Mr. Powell favoured the use of the richer asphalts and thought that a municipality should buy asphalt on the basis of bituminous content, relegating the percentage of colloidal material to a second place.

Mr. Proctor advocated the use of bituminous surfaces as giving the best investment for the municipality. He gave some interesting figures concerning the costs of recent work and the percentage of various classes of work entering into a typical contract.

Mr. Jones described some of the methods found suitable by his company in the laying of bituminous pavements. He strongly advocated the early letting of contracts so that the entire season's work would not be concentrated in six months of time. Mr. Jones also deprecated the practice of requiring a guarantee of from three to five years from the paving contractor.

Mr. Jupp described in some detail the methods followed by his company in the construction of tar macadam road by the penetration process.

Contributions to the discussion were also made by Geo. T. Clark, M.E.I.C., Chairman of the Branch; B. E. Smith of the Barrett Company, Ltd; J. M. Oxley, M.E.I.C.; F. B. Goedike, M.E.I.C.; A. G. Dalzell, M.E.I.C.; Wm. Storrie, M.E.I.C.; and W. J. Smither, A.M.E.I.C.

At a meeting of the executive of the Branch held previous to the regular meeting of Oct. 20, E. L. Cousins, M.E.I.C., G. T. Clark, M.E.I.C. and Wm. Storrie, M.E.I.C., were appointed to be representatives of the annual meeting of the Canadian Deep Waterways and Power Association at Hamilton, Ont.

J. M. Oxley, M.E.I.C., and the Secretary of the Branch were requested to prepare a letter to be sent to the Board of Control of Toronto asking that any money be spent on relief work during the coming winter be devoted to actual productive work and be not merely a straight charity gift.

Nickel Production and Its Uses

The production and the uses of nickel were explained in detail with the aid of moving pictures by C. E. Macdonald, A.M.E.I.C., Canadian Manager of the Electric Alloy Co., and formerly sales engineer of the International Nickel Co., on Oct. 27th. Mr. Macdonald traced the production of nickel from the ore to the finished product, outlining the methods in use by the International Nickel Co. and the Mond Nickel Co. for breaking down the ore body, as well as the method of refining the ore when gained.

Sewer Construction in Vancouver

As the Branch Committee on Engineering Ethics was not in a position to present its report at the meeting of November 3rd, A. G. Dalzell, M.E.I.C. kindly consented to fill in the gap in the programme with an address on "Experiences in Laying 145 Miles of Sewers in Vancouver." Mr. Dalzell described the early construction of wooden sewers in Vancouver and pointed out that some of them had lasted for twenty years or more. He traced the growth of scientific drainage in Vancouver, pointing out some of the mistakes that had been made in the early days through ignorance of the correct method of handling and disposing of sewage. Incidentally, Mr Dazell outlined some of the well established principles that must be observed in planning and carrying out any modern sewerage system.

M. V. Sauer, M.E.I.C., in the absence of the Chairman, presided at the meeting.

At the meeting of the executive held on the same evening, the Branch Chairman was appointed as a representative of the Branch at the annual dinner of the Peterborough Branch with authority to name a substitute in case he could not attend.

A letter from the Fire Underwriters' Association with respect to an opinion on regulations recently framed by it was referred to the Branch Committee on Building By-Laws.

Hydro-Electric Standards

W. P. Dobson, M.E.I.C., engineer in charge of the laboratories of the Hydro-Electrical Power Commission of Ontario addressed the Branch on November 11 on standards adopted by the commission for materials, apparatus and methods of construction used in its work. Mr. Dobson spoke particularly of the standards governing the electrical features of the work, but referred many times to the work being done in connection with standards for construction materials. His remarks were illustrated by lantern slides. In the discussion which followed Wm. Storrie, M.E.I.C., C.R. Young, M.E.I.C., G. A McCarthy, M.E.I.C., R. O. Wynne-Roberts, M.E.I.C. and others spoke.

Machine-made Cast Iron Pipe

At the meeting of November 17, F. W. Hudson, assistant to the general manager of the National Iron Corporation, Ltd., Toronto, spoke on the modern method of manufacturing cast iron pipe by the centrifugal process. He illustrated his remarks by moving pictures. Mr. Hudson traced the method of manufacturing pipes by the sand-mould process and then by the modern process. He described in detail the properties of the new pipes stating that they indicated a marked superiority over the older ones. An active discussion ensued in which the following members took part: Professor R. W. Angus, M.E.I.C.; G.T. Clark, M.E.I.C.; G. L. Ridout, A.M.E.I.C.; Wm. Storrie, M.E.I.C.; Wm. Gore, M E.I.C.; E. M. Proctor, A.M.E.I.C.; C. R. Young, M.E.I.C.; A. C. Oxley, A.M.E.I.C.; R. O. Wynne-Roberts, M.E.I.C.; and others.

Prof. R. W. Angus, M.E.I.C., presided at the meeting.

Peterborough Branch

R. L. Dobbin, M.E.I.C., Secretary-Treasurer.

Annual Banquet

Their annual banquet is considered by the local Branch of *The Engineering Institute* to be the event of the season in engineering circles and this year's function was no exception. Fun and entertainment in large measure, with periods of seriousness, combined to make an evening that will be long remembered by those present.

The guests of the evening included the following prominent engineers and officers of *The Institute:*

Walter J. Francis, M.E.I.C., of Montreal, Vice-President;

Fraser S. Keith, M.E.I.C., General Secretary;

Col. W. H. Magwood, M.E.I.C., of Cornwall, Chairman of Ontario Provincial Div.;

Prof. Peter Gillespie, M.E.I.C., of Toronto University.

The Chairman of the Branch P. L. Allison, M.E.I.C., acted as Toast Master.

After the Toast to the King had been suitably honored the toast to *The Institute* was proposed by R. L. Dobbin M.E.I.C., waterworks superintendent. Mr. Dobbin in his remarks, drew attention to the preponderance of Peterborough men at the head of the affairs of *The Institute,* among whom are, R. A. Ross, M.E.I.C., immediate past President J. R. M. Fairbairn, M.E.I.C., President, Walter J. Francis, M.E.I.C., Vice-President, F. B. Brown, M.E.I.C., Prof. Peter Gillespie, M.E.I.C., Prof. H. E. T. Haultain, M.E.I.C and R. B. Rogers, M.E.I.C., Councillors.

Mr. Francis who replied extended the regrets of the President at not being able to be present. He then proceeded in his usual eloquent style to deliniate the lofty aims and ideals of *The Institute,* and its progress in elevating the status of the profession in Canada. A large part of its success was due to the high calibre and unselfish efforts of the engineers who had graced the presidential office.

We should all be proud to belong to such an organization, as had for its Presidents men like Sir John Kennedy, G. H. Duggan, R. A. Ross, and J. M. R. Fairbairn. The opportunities and possibilities of *The Institute* were boundless, and the degree of accomplishment would depend on how much effort was put into the work by every member.

The key note of all its activities was "Service" and it should be borne ever before each member, that "character" was greater than "career". Engineers in Canada have at least got to the point of realizing that there is something else in the Society besides selfishness. What is taken out depends on what you have put in. Mr. Francis went on to describe the activities of *The Institute* regarding Classification and Remuneration, and the progress of Legislation in the various Provinces, and concluded with an appeal to the members to support *The Journal* by every means in their power.

The Toast to the Branches was proposed by Fraser S. Keith, General Secretary, who told of the growth of *The Institute*, to its present large size. The credit of this was due mostly to the formation of the Branches now numbering 21. For one active member in 1890 we have 20 now. *The Institute* is the only national engineering organization in Canada, and what ever other societies an engineer might join, he should as a matter of loyalty become a member of it. If he does not he is losing the opportunity of his life. In the next five years Mr. Keith prophesied that every engineer who amounted to anything in Canada would become a member.

Professor Peter Gillespie, M.E.I.C., responded on behalf of the Toronto Branch, and extended the greetings of its officers. He described the present good opinion of the engineer in the public mind, and contrasted it with earlier opinions of the opposite kind. In one particular that of mechanical power, great strides had been made. In 1770 there were no aids to industry, except an occasional "Newcomen" engine, or water wheel, and windmills. In 1870 due to the development of the steam engine, the total horse power developed in the world was 18,000,000. In 1906 it was estimated that 17,000,000,000 horse power were being used in industry, and at the present time the amount is prodigious. 20 or 25 years ago when large scale developments of hydro electric power were projected, it was prophesied that the supply would exceed the demand, but it has been found on the contrary that there is never enough power to fill all requirements. At the present time the need of the world is the development of some inexpensive energy. Who can do this, or aid in any way will be the benefactor of the ages. The sun and the tides have been suggested as probable sources, and Sir Oliver Lodge suggests boring a shaft deep into the earth to tap the immense heat located there. Prof. Gillespie concluded by pointing out the limitless field for engineers in this problem.

Col. W. H. Magwood, M.E.I.C., on behalf of the Ontario Provincial Division congratulated the Branch on its healthy condition. He described the progress of engineering legislation in Ontario and else where.

P. L. Allison, M.E.I.C., replied for the local Branch, and traced its history from the beginning, in 1917 as the Engineers Club, to its present state.

The toast to the Sister Professions was proposed by P. P. Westbye, M.E.I.C., who described all the dire things that would happen to the world if all the doctors, lawyers and ministers were to be wiped out of existence. Dr. Ed. Wood, Basil Hall and Rev. Harold Young replied on behalf of their respective professions.

C. E. W. Dodwell's witty letter explaining his absence from the gathering was read. It was the general feeling that the presence of our veteran member from Nova Scotia would have been even more appreciated then his tribute by mail.

A feature of the evening was the singing of the C.G.E. sextette, an organization described on the programme as the only seven man sextette in existence. The personal was as follows.

W. H. Barry—Pioneer (Engineer is a man who runs an engine, Pioneer runs a piano.)

W. M. Cruthers, A.M.E.I.C.,—Messed up soprano.
W. E. Ross, Jr.E.I.C.—Country Alto.
T. E. Gilchrist A.M.E.I.C.,—Tenor Busto.
A. B. Gates, A.M.E.I.C.,—Barreltone.
A. L. Dickieson, A.M.E.I.C.,—Black Bass.
P. Manning, A.M.E.I.C.,—Large mouthed Bass.
H. E. Rose, S.E.I.C.,—Volume.

Several original compositions were sung part of which appear below, and their efforts added greatly to the hilarity and enjoyment of the evening.

"More Hash"

Average Tune "Turkey in the Straw".

Oh! we can't have whiskey and we can't have beer,
We can't have a glass of wine to help us cheer.
So we'll make the best of water to keep our spirits warm,
And another little drink wouldn't do us any harm,
And another little drink, etc.

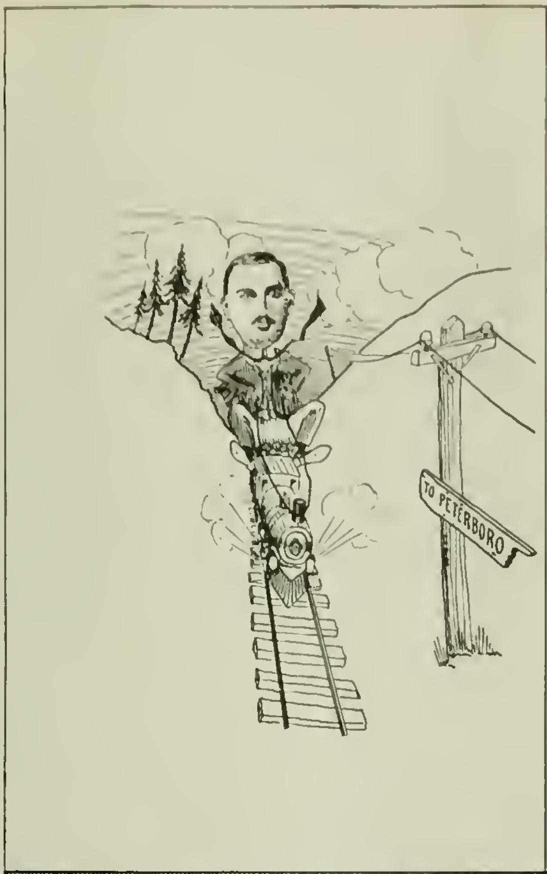
Oh! W. H Sangster at golf he is a bear,
When he gets in the bunker, he is never known to swear
He just breathes a silent prayer, or he sings a little psalm
And another little drink wouldn't do him any harm,
And another little drink, etc.

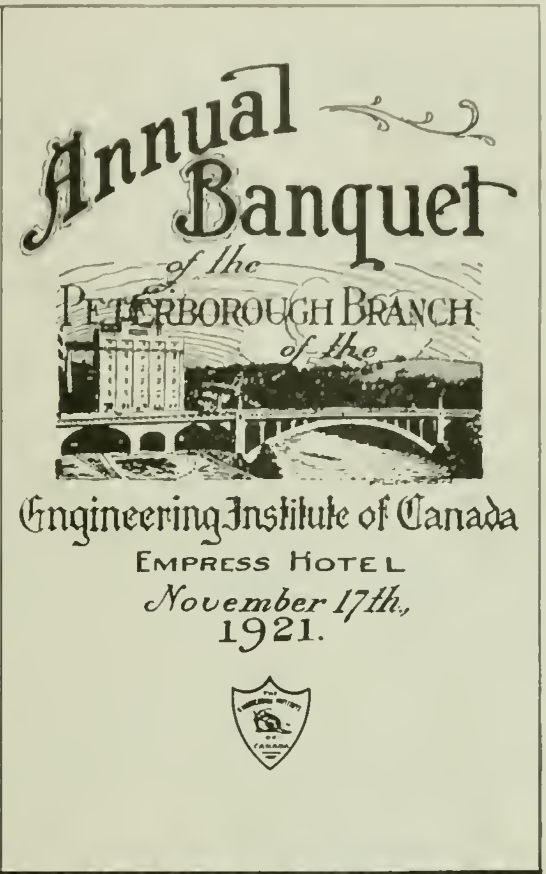
Then there is P. P. Westbye, a man of great renown.
Auto tires, or flies, or milk, he's got'em all tied down.
We have a hunch that he has got shares in a dairy farm,
And another little drink wouldn't do him any harm.
And another little drink. etc.

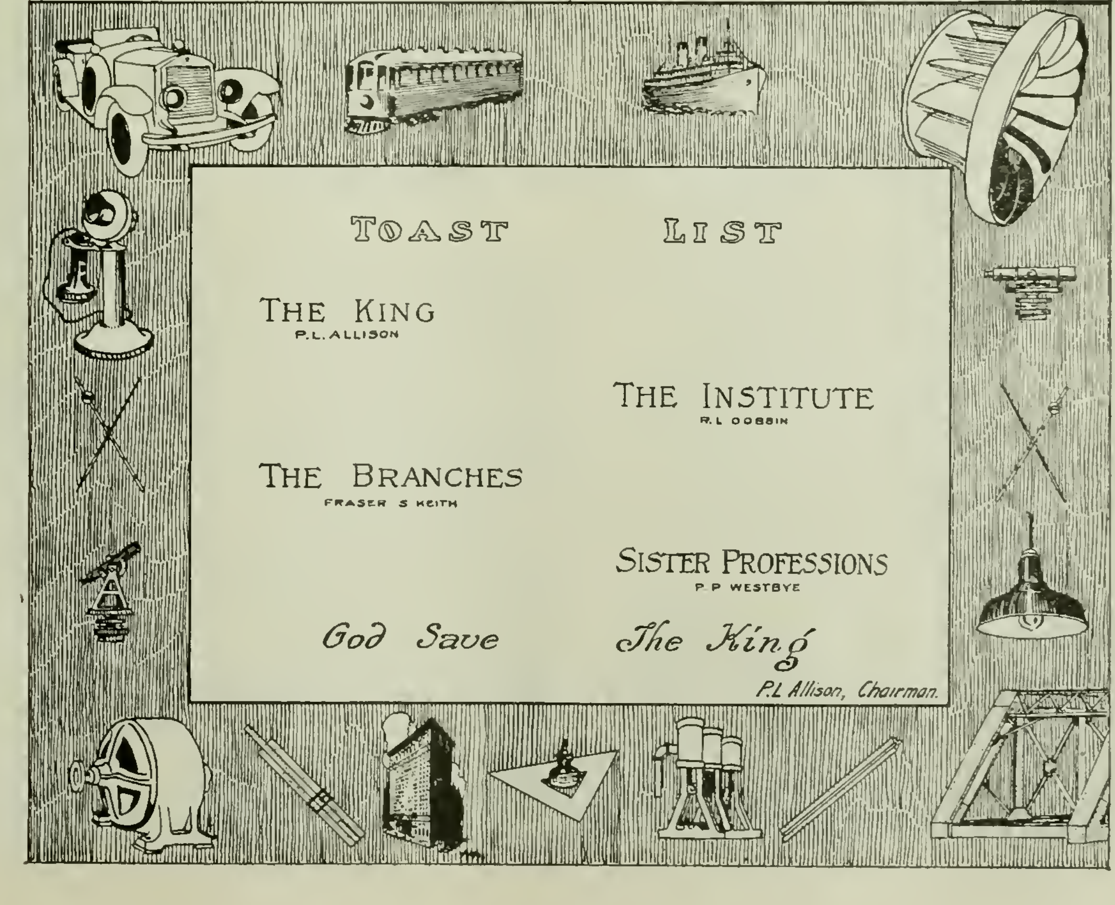
Professor P. Gillespie, we know is quite a judge,
Of the finer points of handling activated sludge.
It is a funny subject, but he handles it with charm,
And another little drink wouldn't do him any harm,
And another little drink, etc.

When you're on the Trent Canal and the Lift Lock starts to sink,
There's water all around you and not a drop to drink.
Killaly is the man who sees the water is kept calm,
And another little drink wouldn't do him any harm,
And another little drink. etc.

When V. S. Foster from some firm receives a hasty note,
"The motor that you built for us will not consent to mote."
He says—"We forgot the rotor, there's no reason for alarm",
And another little drink wouldn't do him any harm,
And another little drink, etc.




Annual Banquet
of the
Peterborough Branch
of the
Engineering Institute of Canada
Empress Hotel
November 17th.,
1921.


TOAST LIST

THE KING
P.L. ALLISON

THE INSTITUTE
R.L. DOBBIN

THE BRANCHES
FRASER S. KEITH

SISTER PROFESSIONS
P.P. WESTBYE

God Save The King

P.L. Allison, Chairman.

MacLaren is our Secretary, and he has all his life
Been a selfish bachelor, but when he gets a wife
We think that it will tend to make him lose his studied calm,
And another little drink wouldn't do him any harm,
And another little drink, etc.

Oh!—Colonel Magwood, you came in rather late.
To do without your dinner, was very near your fate.
But we put a bit upon one side and tried to keep it warm,
And another little drink wouldn't do you any harm,
And another little drink, etc.

We notice Fraser Keith is smiling at our song,
He thinks that really it has been dragged out a bit too long.
Well, he comes up from Montreal, but we will bet a farm,
All the drinks he brought for us won't do us any harm,
All the drinks, etc.

"An Ode to the F. & G. P. Association

Tune—"Solomon Levi" (More or Less)

My name is R. B. Rogers, I live out on the farm,
That's where I shot a squirrel although I meant no harm.
Then some poor prune flew off the bat,
And spilled the beans on me,
And Davy said, "Just twenty bucks"
And then you can go free."

Chorus:

Oh! R. B. Rogers, why did you shoot
The oldest member, disgracing The Institute.

Registration

W. J. Francis
P. Gillespie
Col. Magwood
F. G. Keith
B. D. Hall
Dr. E. H. Wood
Rev. Harold Yonge
P. L. Allison
P. Alexander
B. L. Barnes
W. H. Barry
W. M. Cruthers
Geo. C. Carruthers
R. S. Cotton
A. E. Caddy
Geo. Coutts
Wm. Cornell
A. L. Dickieson
R. L. Dobkin
H. A. Fife
H. O. Fiske
R. C. Fletton
I. A. G. Goulet
R. Grant,
I. E. Gilchrist
A. B. Gates
Geo. Gladman
A. L. Killaly
L. B. Kingston
W. A. Logan
I. A. Lang
L. D. W. Magie
Jas. Mackintosh
A. P. Miller
A. H. Munro
A. L. McLaren
H. C. Morley
R. H. Parsons
L. Potvin
C. H. Rogers
R. B. Rogers
A. A. Richardson
Alex. Richardson
H. Rose
A. Roberts
C. E. Sisson
N. D. Seaton
E. R. Shirley
J. B. Parleur
R. Sturgeon
Wm. Sangster
P. P. Westbye
R. E. Wilson
F. Mc Neilby
J. F. Woolnough
John Fentee
N. Geale
W. H. Dunsford
H. Ritchie
E. L. Miles
G. B. Smith
F. D. Gifford
J. Black
J. B. Walcott
J. E. Hess

On October 27th Prof. Peter Gillespie, M.E.I.C., gave an illustrated lecture on Municipal Sewage Disposal, in the Assembly Room of the Chamber of Commerce. There were about fifty members present.

The first meeting for the month of November was held on the 10th, and was addressed by A. G. Dalzell, M.E.I.C., for a number of years city engineer of Vancouver on "The Construction of 140 Miles of Sewers in Vancouver B.C."

Kingston Branch

L. T. Rutledge, M.E.I.C., Secretary-Treasurer.

The regular second meeting of the Kingston Branch for the month of October was held on October 25th. William Casey, general manager of the Kingston Locomotive Works Limited. gave a very instructive lecture on "Cost-Keeping" applicable to a large manufacturing industry. Mr. Casey treated the subject in a logical order, first listing and explaining a major classification of accounts, after which he dealt with each division in detail. The speaker explained fully an efficient method of arriving at the probable cost of a locomotive on any new order received, or which was to serve as a basis for a tender.

On November 8th, the Branch members along with a goodly number of visitors listened with special interest to a general and detailed description of the new central heating and power plant now under construction on the water-front at King Street on the site of the former Kingston Hosiery plant, for Queen's University and Kingston General Hospital. The speakers were Professors W. P. Wilgar, M.E.I.C., and L. M. Arkley, M.E.I.C. two of the consulting engineers on the design and construction.

Prof. Wilgar described the construction of the concrete tunnel, now partly completed, which will connect the heating plant with the Hospital and the University and contain all water, and steam mains and power and electric light wires and conduit. The section of the tunnel is rectangular, walls nine inches thick, and the inside height is almost six feet. The tunnel is below the ground surface for the entire length.

Special engineering difficulties were encountered in the excavation for the tunnel due to old water mains and sewers whose location was unknown and unrecorded. Part of the tunnel is below the level of Lake Ontario. Hydrated lime is being mixed with the concrete to render the latter watertight.

Prof. Arkley, who is in private practice a consulting heating and ventilating engineer, described the proposed plant using a complete set of drawings to illustrate. After explaining the need of such a plant, he showed why the water-front was selected for the site. A few of the outstanding reasons are the following: coal can be obtained directly from the lake barges which can unload at the dock on the property and ample storage space for coal is available on the property. There is an abundant supply of free water available. The disagreeable smoke and chimney gas nuisance will be eliminated by the use of a high chimney.

The new building which is a very pleasing design is to be built in the form of the letter "T". The front of the plant facing King Street is 150 long and the depth of this section is 46 feet. The rear section being the boiler house, symmetrically placed relative to the front section is 80 feet by 50 feet. The power plant will occupy the Eastern half of the front section and a thermodynamic laboratory the Western half. The building will be made of stone, the fire walls inside of brick and the laboratory will be lined with a good face brick.

The boiler capacity will be 1600 boiler horse power, two new water-tube boilers of 500 h.p. each having been purchased. The present boilers at the University will be moved down next summer. The overload capacity of this plant will be almost 100 per cent. The most modern equipment in the way of automatic stokers, coal bunkers, coal weighing equipment, carbon dioxide recorders etc., will be installed. The present steam engine equipment of the University supplemented by a couple of steam turbines will be used to drive the electric generators to provide electric power for the University buildings.

The thermodynamics laboratory is to be complete in every detail for the teaching of steam engineering and will be, when finished, one of the best and most modern on the continent. The whole plant is being designed with the idea of making it an ideal experimental plant as well as an efficient heating plant.

The General Hospital will be heated with hot water heated in the power house by the exhaust steam from the engines. The hot water will be forced to the hospital through two six inch mains by turbine driven centrifugal pumps. The University buildings will be heated with steam by a low pressure vacuum system. The steam will arrive at Fleming Hall as high pressure steam where the pressure will be reduced for distribution to the various buildings. A vacuum pump in the power plant with a 4-inch return pipe will take care of the returns, the condensed steam, and return it to the boilers.

Prof. Arkley discused many vital points relative to the subject, for instance the relative merits of heating by steam and hot water, expansion in pipes and methods of providing against it, condensation, radiation, merits of water tube boilers, proper method of mechanical stoking and various other details.

A hearty vote of thanks was tendered Professors Wilgar and Arkley for their very instructive and interesting lecture.

Ottawa Branch

F. C. C. Lynch, Associate E.I.C.

Public vs. Private Management of Street Railways

At a meeting of the Branch held on November 10th in the University Club an interesting paper was read on public versus private management of street railways by G. Gordon Gale, M.E.I.C. In the introduction to the paper it was pointed out that public ownership of street railways was almost unknown in the early days of electric lines. Public ownership and management was brought about largely by increasing costs and accelerating growth of cities which forced heavy expenditures upon the companies while at the same time public opinion opposed increases in fares. The declining value of private company stock frequently forced diminished service as a necessary economy and in many cases many cities were induced to manage their own street railway systems. In some cases the desire to give adequate service and unnecessary line extensions provided too good a service for the fare with resulting financial loss. The speaker favoured as the best solution of the problem of management operation and management by a private company under a service-at-cost agreements. Under this arrangement fares would be adjusted by commissioners appointed by the city who would be fully in touch with all conditions. This would give adequate service since the management would be under experts, at the same time the city through its commissioners being able to prevent undue profits. The evils of political "pull" would also be avoided and as the city would not have to purchase the system outright a heavy capital expenditure would also be avoided.

Following the paper an animated discussion took place in which the following members took part: George Mountain, M.E.I.C., John Murphy, M.E.I.C., D. W. McLachlan, M.E.I.C., A. F. Macallum, M.E.I.C., A. A. Dion, M.E.I.C., Fred. Burpee, M.E.I.C.

Rock Drilling

At the open meeting of the Branch on the evening of the 15th instant, held in the Victoria Museum, P. S. Sherrin, A.M.E.I.C., of the Natural Resources Intelligence Branch of the Department of the Interior, graphically described drilling operations which had come under his supervision in many countries, including Russia, Rhodesia, England and Canada. The subject of the evening was "Rock Drilling", and was illustrated by four reels of film supplied through the courtesy of the United States Bureau of Mines and the Sullivan Machinery Co. One of the reels featured the construction work on the Chippawa hydro-electric power canal, and was greatly appreciated. Mr. Sherrin gave interesting data on mining conditions and mining by the use of explosives, tracing the early history of the work, especially that in the gold mines of Rhodesia, where indications were visible of mining operations conducted approximately one thousand years ago. A large audience listened appreciatively to the lecturer and viewed with expressed approval the interesting films.

Petroleum and its Production

At an open meeting of the Ottawa Branch on October 20th, C. I. Grierson, B.Sc., technical engineer of the Imperial Oil Co., of Toronto, gave an interesting and instructive address on "Petroleum and its Production". Mr. Grierson gave an outline of the history of the petroleum industry, and the progress which had been made in its development, with especial reference to refining methods and the vast range of derivatives from the original crude oil. The different qualities of the crude oil were referred to as also the oil fields from which they are secured. He emphasized the fact that while the Norman well of the Imperial Oil Co. was not a gusher, the field was one of great promise, and that after a period of intensive development it was hoped the Mackenzie oil field would prove of immense value. Mr. Grierson showed a film of the Imperial Oil Company's plant at Sarnia and their distribution system throughout Canada, which demonstrated the immensity of this company's organization.

Professional Institute of the Federal Civil Service

The Professional Institute of the Federal Civil Service held its annual meeting in Ottawa on Nov. 1 and 2, members of the E.I.C. taking a prominent part on the proceedings. At a luncheon at the Chateau Laurier, Sir Robert Falconer, president of Toronto University, was the guest. The president of the Professional Institute, K. M. Cameron, M.E.I.C., was in the chair, and among the members of the E.I.C. at the head table were Messrs. T. Shanks, Com. C. P. Edwards, George Mountain, A. St. Laurent and J. B. Challies.

Canadian Geodetic Society

The opening meeting of the season of the Canadian Geodetic Society was held on Thursday afternoon, Nov. 10, at the Geodetic building, Ottawa, when H. F. J. Lambart, M.E.I.C. gave an address on "Reconnaissance from an Aeroplane." The speaker referred to his work during the past season, having started out to make certain surveys in British Columbia from Vancouver East to Kamloops. Mr. Lambart claimed a saving of from ten to twelve thousand dollars by the use of the air craft, as data were secured during the past season when assisted by the aeroplanes that would have taken three years to obtain by foot survey parties and a land climb. At the conclusion of the lecture questions were asked by members of the society, among those taking part being N. A. Ogilvie, M.E.I.C., Director of the Geodetic Survey; Colonel Leckie of the Air Board; and E. F. Drake, A.M.E.I.C. Director of the Reclamation Service.

International Joint Commission Meeting

The public hearings of the International Joint Commission were held at Ottawa, November 14th and 15th, 1921: when different engineering schemes for canalization and power development of the St. Lawrence river between Lake Ontario and Montreal were presented, a large number of *Institute* members attended.

Ottawa Engineers in the New Oil Fields

During the past season, members of the Ottawa Branch of *The Engineering Institute* connected with the Topographical Surveys Branch of the Department of the Interior were engaged on surveys and explorations in the Mackenize district embracing the oil and mineral areas of Great Slave lake and Mackenzie river.

Approximately 4,000 miles of shore line were traversed and data were secured for a detailed map of the Westerly half of Great Slave lake, and the Slave and Mackenzie rivers to Sans-Sault rapids, within a few miles of the Arctic circle.

As a control for the surveys, the Dominion Observatory Branch established the position, by latitude and longitude observation of certain points throughout the area surveyed.

Early in the season buoys were planted in the more dangerous river and harbour channels of Great Slave lake and the Mackenzie river.

On exploration, a route from Fort St. John on Peace River to Nelson and Liard rivers, thence to the Mackenzie at Simpson, proved it to be practicable for winter freighting to the head of navigation on the Nelson river. This route would enable a party to reach the oil fields at Norman nearly six weeks before the ice on Great Slave lake permitted transportation by the regular route.

Information gathered during the season with maps corrected to date will be published in due course.

The following members of *The Institute* were engaged upon this work: G. H. Blanchet, D.L.S., W. H. Norrish, D.L.S., E. P. Bowman, D.L.S., Fred V. Seibert, D.L.S., B. H. Segre, D.L.S.

Local News

Captain F. Anderson, M.E.I.C., of the Hydrographic Survey, Naval Department, has just returned to headquarters. The Hydrographic Service Steamer "Acadia" under his control was engaged during the summer on the original survey of Hamilton inlet, Labrador, where Capt. Anderson and the parties under his charge, have been working in the preparation of an accurate chart of that vicinity.

C. P. Edwards, M.E.I.C., the Chairman of the Ottawa Branch, has been elected a member of the Canadian Engineering Standards Association.

R. J. Durley, M.E.I.C., Secretary of the Canadian Engineering Standards Association, visited Toronto on the 9th when the Sub-committee of the Standards Association on Concrete and Reinforced Concrete took place. Whilst in Toronto, he also addressed the local members of the Association of Mechanical Engineers.

The Ottawa Branch is looking forward to the visit of the President on the 8th December, when a lunch will be given in his honour at the Chateau Laurier.

The Branch proposes to give a "smoker" to the local members on December 15th, at the Chateau Laurier. A first-class programme is being arranged and a good attendance is looked for.

Montreal Branch

J. L. Busfield, A.M.E.I.C., Secretary-Treasurer.

Welding

On October 20th, two papers were read, one by A. M. Barry on "Thermit, Electrical and Oxy-Acetylene Welding", the other on the "Metallography of Welding" by W. H. Ludington. The papers were illustrated by a number of lantern slides and with moving pictures, and a lively discussion followed indicating that the two authors had somewhat different lines of thought.

Sir John Kennedy, Hon. M.E.I.C.

On October 27th, the meeting opened with a resolution of regret at the death of Sir John Kennedy, Hon. M.E.I.C., F. W. Cowie, M.E.I.C., chief engineer of the Harbour Commission presented the formal resolution of regret.

"It is proper" said Mr. Cowie, "that to-night this *Institute* place on record a fitting tribute to the late Sir John Kennedy, a past-president of this *Institute.* To-day the remains of that great man, eminent engineer and kind friend, have been laid to rest, and we all mourn that fact. *The Engineering Institute of Canada* has lost a valuable member; the engineering profession of Canada has lost one of its most worthy exponents; Canada has lost a man who had made his mark in the developments, improvement and success of many vital links in the chain of her prosperity."

For thirty-eight years, said Mr. Cowie, he had been associated with Sir John Kennedy in connection with the improvements of the St. Lawrence Channel, the development of public harbours in Canada, and especially the development of the port of Montreal. It was no small thing, he said, to have been thus intimately connected with so great an engineer, whose life meant much for the development of the Dominion, and whose death was a distinct loss to this Country and to the engineering profession.

Mr. Cowie therefore with evident feeling, presented the following resolution:

Resolved that the Chairman, Executive and members of **The Engineering Institute of Canada** deeply mourn the death of Sir John Kennedy, but that they feel consolation in the thought that their late friend and confrère was spared to a ripe old age, to give the benefit of his sound advice and counsel to **The Institute**, as well as to the members personally. The Montreal Branch of **The Institute** desires to put on perpetual record some of the notable acts of their late friend, both in his public and private life, so that his career will be an inspiration to those who come after.

Sir John Kennedy was eminent as an engineer, both on the Continent of America and abroad, and his sound professional judgment was invoked on many occasions and his suggestions carried out to a successful issue In the field of hydraulic engineering, mechanical and construction problems, his genius was outstanding. Notable among his successes were the deepening of the river St. Lawrence and the development of the Port of Montreal under the Harbour Commissioners. The manner in which he carried out the improvements to the River St. Lawrence Ship Channel is outstanding, and the method he adopted and the mechanical means to that end are still in many particulars followed by his successors.

"In paying this last tribute to our departed friend and counsellor we cannot forget the part he took at the inception of this society and the constant attention he gave to its problems and welfare.

As a citizen he was beyond criticism, and although he took no active part in civic government, his advice was often sought and freely given. His Christian character was without reproach and his domestic relations were of the happiest.

The members of the Montreal Branch of **The Institute** offer their heartfelt sympathy to the family and relatives, and pray that consolation will be afforded to them by dwelling on the record left by him after a long and successful career. To the partner of his life's joys and sorrows, we especially tender our sympathy and trust that Lady Kennedy will yet be long spared to be a comfort to her bereaved family."

This was seconded by W. F. Tye, M.E.I.C., past-president of *The Engineering Institute of Canada*, who said that Sir John Kennedy's death was a loss to *The Engineering Institute*, to this port and to Canada generally. But their sorrow at his death was mingled with pride that after a long life Sir John Kennedy had died, with a record of much achievement and many honours to recognize the work he had done.

"Sir John Kennedy achieved great works for Canada" concluded Mr. Tye, "His work was an inspiration to those engineers that came after him. His life after his affliction of blindness was an even greater inspiration. He kept up his interest in engineering, he continued his connection with the harbour and channel work, and the affairs of Canada generally, and to all of us it was a pleasure to see the manner in which, though he had lost his sight, he had not lost his insight into the work that he had directed so long. We all feel that we have lost an old friend and a man whose abilities were directed to the benefit of this city and of this Dominion".

The resolution was then unanimously adopted in silence, the whole gathering standing with bowed heads for several seconds.

Inauguration of Marine Section (Oct. 27th)

An event of considerable importance to the engineering profession took place at this meeting. This was the inauguration of the Marine Section of the Montreal Branch. I. J. Tait, M.E.I.C., vice-chairman of the Marine Section presided and called upon N. E. McClelland, M.E.I.C. Chairman of the Marine Section to present his paper on the Construction of 10,500 ton ships at Halifax. It is anticipated that this paper will be reproduced in a future issue of *The Journal*.

In moving the vote of thanks to Mr. McClelland, Dean Adams of McGill University stated that a Chair of Marine Engineering was already having serious consideration.

Aeroplane Engines

On November 3rd, 1921, P. E. Biggar, S.E.I.C. read an extremely interesting paper on Aeroplane Engines, with Chas. M. McKergow, M.E.I.C. presiding.

Pulverized Fuel

On November 10th, 1921, a paper was read by H. A. Reichenbach of the Fuller Engineering Company of Allentown, Pa, on Pulverized Fuel and its Uses. Mr. Reichenbach described the series of experiments which had gradually led to the successful use of pulverized fuel as a means of producing heat and power. These experiments he said had been going on for the past thirty years in the steel and cement industry, until they had reached a stage where the process was being successfully used by a number of big plants in both the United States and Canada.

The discussion was opened by H. D. Savage of the Combustion Engineering Corporation of New York, who spoke from an extensive experience of the development work in connection with the use of pulverized fuel. He laid stress on the possibilities now open for the utilization of some of the low grade fuels available in Canada.

John T. Farmer, M.E.I.C. presided.

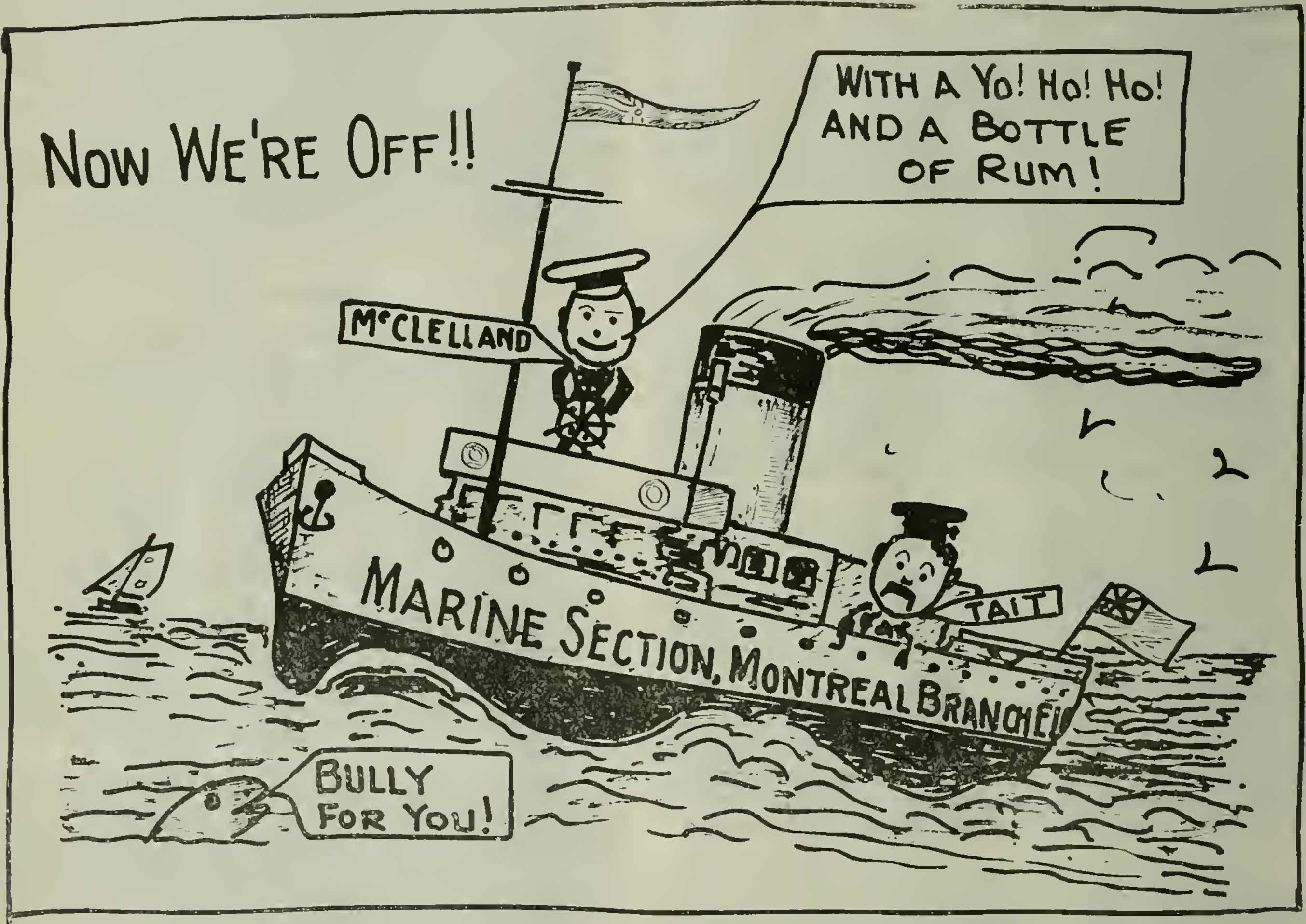
Inauguration of Railway Section

At the meeting of November 17th the inauguration of the Railway Section of the Branch took place. P. B. Motley, M.E.I.C., Chairman of the Railway Section presided, and in his opening remarks said that the word "Inauguration" was something of a misnomer, as the old Canadian Society of Canadian Engineers had been largely made up of railway engineers, and that the present meeting was really the marking of a reviving of interest of the Railway engineers in the Montreal Branch of *The Institute*.

The Secretary opened the meeting by reading a poem describing the genesis of the Railway Section, part of which follows:—

"The Canadian Society of Civil Engineers
(In Eighteen Eighty-Seven, 'twas founded,)
Was known as such for many years.
And a very fine name it sounded.

In the days of the old Society, 'tis known,
The Railway men were numerous,
And in **The Institute** they hold their own,
E'en though they thought it humorous.


NOW WE'RE OFF!!
WITH A YO! HO! HO! AND A BOTTLE OF RUM!
McCLELLAND
TAIT
MARINE SECTION, MONTREAL BRANCH E.I
BULLY FOR YOU!

There came a day when rumours had spread,
To Windsor and McGill Street too.
That Montreal Branch was far from dead,
And was raising a hullaballoo.

So Motley called Going and to him said.
What is this thing I hear?
Damn little I know except what I've read
In **The Journal**, said Going with fear.

Then with heads together the two did plot,
To solve this problem great,
And there they sat and talked quite a lot,
Until it grew quite late.

Said the one to the other the solution might be,
The formation of a railway section
The other agreed that he would like to see,
It done before the election."

Following this, two papers were read, one by C. H. Tillett, signal engineer of the Grand Trunk Railway on Automatic Signalling, and the other by C. W. Parker, signal engineer of the Canadian Pacific Railway on Interlocking Signalling. Mr. Parker had installed a large amount of apparatus in the hall. and gave some practical demonstrations with staff holders and illuminated diagrams. A moving picture film entitled "Up and Over" showing the passing of a train through the Rocky Mountains was also shown.

St. John Branch

Harry F. Bennett, A.M.E.I.C., Secretary-Treasurer.

Visit to New Cantilever Bridge

The members of the St. John Branch paid a visit to the new cantilever bridge over the St. John River at St. John on the afternoon of Saturday Oct. 15th.

Before looking over the bridge, Major C. F. Draper, resident engineer for the C.P.R., explained the reasons for placing the structure in its present location rather than between the old cantilever and the highway bridge. The dimensions of the bridge are: main span—450 feet, consisting of two cantilever arms each—150 feet, and a suspended span—150 feet; each anchor arm is 125 feet in length. If the location between the bridges had been used the span would have been 525 feet.

Weight of material in the work:—steel:—main cantilever, 2000 tons, balance of bridge, 315 tons, concrete, 5620 cu. yds; masonry, 500 cu. yds.

It had been planned to use St. George, N.B. granite facing up to the bridge seats, but a strike at the works interfered with the delivery and the facing only extends to high water mark. Lead wool is used in pointing the stonework.

Both main piers rest on mixed limestone rock below water level, the East pier is stepped up on the rock and the West pier foundation was excavated shoreward of high water mark. Graphite and asbestos were found in the excavations. The East anchor pier is small as the anchor grillage is embedded in the solid rock. The West anchor pier is built for weight and contains 1000 cu. yds, with a weight of about 2000 tons. When the span is completed it will be loaded with ballasted cars which will place the anchors in one-half maximum tension causing a stretch of about 3-sixteenth inches. The anchor chains will then be concreted in the piers and the load left on for two or three weeks till the concrete has set. This will relieve the concrete in contact with the chain plates from tension and prevent cracking.

Two of the approach piers at the Eastern end are set on the rock, the remainder have spread footings on hard pan. The piers, and in fact the whole structure, are built economically. The approach piers are reinforced with 3-4 inch bars at 12 inch centres and have a large factor of safety. Standard plate girders, 70 feet long and 9 feet centre to centre connect the approach piers. These are anchored at the Eastern ends and the Western ends slide on circular cast shoes lubricated with a patent grease.

The members of the Branch are very grateful to Major Draper for his very interesting explanations and the privilege of viewing the work under his direction.

Visit to Radio Finding Station

On Saturday afternoon, Nov. 12th, the members of the St. John Branch paid a visit to the Government Direction Finding Station at Red Head. The party was shown through the station by Mr. G. F. Harris, who is in charge of the plant, and the various details explained to them. This Finding Station, which has been in operation less than a year, has already proven its usefulness in locating vessels at sea and, in conjunction with similar stations at Cape Race, Canso, Chebucto Head and Bar Harbour, Me., it is constantly in use assisting navigation. In addition to its work as a finding station, commercial messages are also received and transmitted. The sending radius of the station is about 300 miles but it can receive messages from any distance. These stations are maintained by the Department of Naval Service under the supervision of Commander C. P. Edwards, A.M.E.I.C., of the Radio Telegraph Service. Their usefulness is becoming more apparent and their locating methods have reached a high degree of accuracy.

The thanks of the visitors were extended to Mr. Harris and his Assistants by Frank P. Vaughan, M.E.I.C., Chairman of the Branch.

Electro-Therapeutics and X-Rays

The regular November meeting of the Branch was held on Nov. 17th., in the Orange Hall, F. P. Vaughan, M.E.I.C., was in the chair and about 30 members and visitors were present. The regular business of the meeting was taken up and the matter of investigation into the charges made regarding the 36″ reinforced concrete pipe to Spruce Lake was discussed. The Committee has been asked to bring in a report to the Branch at its next meeting.

The speakers of the evening were Frank P. Vaughan, M.E.I.C., who dealt with Electro Therapeutics and Dr. W. E. Rowley, who explained the various features of the X-Ray work from a medical viewpoint.

With the aid of lantern slides, Mr. Vaughan explained the various features of the different methods used in the treatment of diseases by Electricity. It was necessary he said, to develop high frequency currents and there were employed in four different ways:—

(1) Vacuum Electrodes, (Violet Ray tubes)
(2) Effleuve, or High Frequency spray,
(3) D'Arsonval Auto-Condensation,
(4) Diathermie.

The Violet Ray is effective in the treatment of local pain or inflammation, and, by increasing the blood circulation, removes waste products which cause rheumatism and gout. The Effleuve, or purple brush discharge, subjects the treated surface to a literal bombardment of electric projectiles thus stimulating and vitalizing the tissues. The remarkable therapeutic effect of D'Arsonval currents, is their power to liberate heat in the tissues of the body and it is applied with great benefit to patients suffering with hardening of the arteries. For diseases in which it is necessary to induce or regenerate inflammation promote circulation or absorption, or increase cell activity, the diathermic method is employed.

Whenever an electric spark passes through the air, ozone is liberated. It is a colourless gas, possessing the odor of chlorine or moist phosphorous. Under pressure, the colour of the gas is blue, and when liquefied, it becomes a dark blue, mobile liquid, with highly magnetic properties.

Ozone is used in ventilation, chiefly on account of its power to destroy organic odors. There are some diseases in which it is used with benefit, namely, anaemia, diseases of the respiratory organs and impaired nutrition. It was used in the treatment of gas victims during the war and gave considerable relief from the agonies of gas poisoning.

The branch of Electro therapeutics which has received the most attention and which has been of wonderful assistance in diagnosis in medicine, surgery and dentistry, is the Roentgen or X-Ray. It is believed that the X-Ray is a disturbance of the luminiferous ether, similar to visible light, but having a much shorter wave length than ultra violet light. Its use has revolutionized the systems of diagnosis and made possible a closer study of the internal actions of the human body.

At this point in the meeting Dr. W. E. Rowley explained the various features of the X-Ray photos shown on the screen. He stated that where formerly it required 15 minutes to take a good photo it was now completed in a few seconds. The result is a series of lights and shadows from which the practicioner could determine the relative positions of the parts of the body and their physical condition. To show the stomach and other organs, a mixture of Bismuth or Barium paste was introduced into the organs which formed a coating on the lining and photographed as a shade.

At the conclusion of the addresses considerable discussion took place and a vote of thank was moved by A. R. Crookshank, M.E.I.C., and Geoffrey Stead, M.E.I.C.

Moncton Branch

M. J. Murphy, A.M.E.I.C., Secretary-Treasurer.

The first Supper Meeting for this season of Moncton Branch was held in the Happen Inn Tea Rooms, Moncton, on Thursday evening, November 3rd, at which Fred. H. Williams, M. Sc.,A.M.E.I.C., assistant electrical engineer, Canadian National Railways, with headquarters at Moncton, delivered a very interesting and instructive address, illustrated with lantern slides . The lecture dealt with research work in electric welding, showing equipment, welds and the microscopic examination of steel and cast iron.

The meeting opened with a dinner after which a musical programme was given, group songs being rendered by Mesdames Thomas H. Walsh, and Clyde Stevens, and Messrs. T. H. O'Brien and Geo. Davidson with Mrs. Geo. Davidson, accompanist.

J. D. McBeath, A.M.E.I.C., asistant city engineer presided and onopening themeeting, extended the congratulations of *The Engineering Institute* Moncton Branch, to the speaker on whom McGill University, recently conferred the degree of Master of Science in Electrical Engineering.

The slides, the result of the personal research work of Mr. Williams were fully explained by him. Votes of thanks were extended to Mr. Williams, and to those who had assisted in the musical programme —Mesdames Walsh and Stevens, and Messrs. Davidson, O'Brien, Ambrose, Dr. Fred Burden and accompanist Mrs. Geo. Davidson. Professor McKeil also spoke.

Cape Breton Branch

Kenneth G. Cameron, A.M.E.I.C., Secretary-Treasurer.

On November 1st. the new premises of the Bank of Commerce at Sydney, were thrown open to the public for inspection, and by no means the least attraction, in a very modern and attractive building, were the new rooms of the Mining Society of Nova Scotia. The Cape Breton Branch, E.I.C. are fortunate in being allowed the joint use of these rooms at a very moderate consideration, as they are central, well furnished and contain a library unique in Nova Scotia.

On November 9th. following a general business meeting of the Branch was held in these rooms. The Chairman, C. M. Odell, M.E.I.C. presided, and the numbers and enthusiasm of those present indicated a successful season.

The business of the evening was mainly a discussion of ways and means, it being decided to make a local levy on the Branch members. A Papers and Meetings Committee was appointed, consisting of T. J. Brown, M.E.I.C., K. H. Marsh, M.E.I.C., A. P. Theuerkauf, M.E.I.C., and R. J. Fisher, A.M.E.I.C. To co-operate with this committee, a Social Committee was also appointed consisting of H. Longly, M.E.I.C., A. W. McMaster, A.M.E.I.C., and R. M. Mackinnon, A.M.E.I.C.

Halifax Branch

O. S. Cox, A.M.E.I.C. Secretary-Treasurer.

No regular meetings of the Branch were held during the summer months. On Oct. 20th, activities for the season began with a meeting held in the Nova Scotia Technical College at which Prof. F. H. Sexton delivered a most interesting address on his recent trip to Europe. Although Dr. Sexton's remarks were not of a strictly engineering character, they were none the less interesting and instructive, the speaker being a man who can absorb a great deal of information from his travels and who possesses the ability to pass it along to others in an interesting way.

He described in an easy narrative style the after-war conditions and problems facing the different countries of Europe, giving his impressions of the various peoples, their customs, characteristics and peculiarities, and the adaptability and resource with which they are coping with these new problems. The characteristic stability of the British workers had been shaken by the war resulting in a certain amount of moral slackness. Indolence and a dependence on trade unions developed dishonesty. Fortunately this feeling is disappearing. England is working her way through and has advanced considerably towards the honest thrifty methods for which she is renowned. France with 50% of her productive men wiped out by war, has been greatly handicapped. The prodigious problem of reconstruction is being grappled with both France and Belgium. The wire entanglements and the great masses of debris are being cleared away and the country is already producing magnificent crops. Buildings are being replaced, roads are rebuilt, the trains are running regularly and many of the problems have been, and are being solved, through hard work and thrift.

Having visited the scene of many of the decisive battles, the speaker was able to describe accurately and vividly the manner in which they are carried out. The impression which Dr. Sexton brought back to Canada as a result of his observations, was the necessity for thrift and hard honest work by our people here. We would strive to develop the idea of democracy. Every man should stand on his own feet, give his bes effort, work and save, not depending on class or trade union to protect and encourage indolence.

The meeting which was presided over by the Chairman, C. E. W. Dodwell, M.E.I.C., extended its hearty thanks to Dr. Sexton for his interesting address.

General Tramway Engineering

The regular monthly meeting of the Branch was held at the Green Lantern on Friday, Nov. 18th. Number present—42 including three guests. C. E. W. Dodwell, M.E.I.C. Chairman of the Branch presiding. The meeting took the form of a social gathering, supper being served at 6.30 P.M., after which I. P. MacNab, M.E.I.C., presented an intensely interesting paper on "General Tramway Engineering."

Mr. MacNab who is tramway superintendent for the Nova Scotia Tramways and Power Co., traced the development of the tramway industry from its inception down to the present day, showing the gradual evolution from the early crude types of track and equipment, to the modern present day efficiency in every phase of its equipment and operation. The speaker brought out many points that are quite generally overlooked or altogether unknown to the public at large as well as to a great many members of the engineering profession. Many of the difficulties and problems met in tramway construction and operation were described, as were the methods of meeting and overcoming the same. Mr. McNab emphasized the fact that thoughtlessness on the part of the travelling public is not only responsible for many of the difficulties in tramway operation, but is responsible for the majority of the discomforts and delays which an unthinking public is all too prone to lay at the door of the operating company. It was pointed out that a campaign of education and a better understanding between the tram company and the public would make for a better and more satisfactory service, and would greatly reduce the troubles and worries of all concerned.

Considerable discussion followed the paper which was participated in by several of the members and guests. After the discussion, which brought out many interesting points of the subject, Mr. McNab was tendered the hearty and appreciative thanks of the Branch.

The guests included Messrs. Loud and Phillips of Jackson and Moreland, Boston, and H. A. Lemmon who is in charge of the Personel Department of Stone and Webster, Inc.

Town Planning Notes and Comments

H. L. Seymour, A.M.E.I.C.

NOTE:— *In order to make this column of wide interest to members of The Institute, personals and items of town planning interest will be appreciated. Address: H. L. Seymour, A.M.E.I.C., 40 Jarvis Street, Toronto.*

Ontario Town Planning and Housing Conference

On October 31st and November 1st, there was held in Toronto the second Ontario Town Planning and Housing Conference, formally opened by his Honour, the Lieutenant-Governor.

The first day was devoted particularly to town planning matters and was opened by the address of President J. P. Hynes, A.M.E.I.C. Noulan Cauchon, A.M.E.I.C., chairman of the Town Planning Commission, Ottawa, led an interesting discussion with his address on "Status of Town Planning in Ontario." The point was emphasized that Ontario legislation regarding town planning was scattered through various provincial statutes. It was the general concensus of opinion that but few municipalities were aware of the exact powers they possessed. In recognition of this fact, a resolution of the conference to be forwarded to the local Government, incorporates a statement of the condition and includes a request for some advance in legislation.

The greater part of the second day session was devoted to "Housing". In the afternoon Dr. Horace L. Brittain, Bureau of Municipal Research, Toronto, spoke on "A Municipal Town Planning Department" making the claim that such a department was just as important to a city as any of its other civic departments.

It would greatly strengthen the position of the commissioner of works or head of the town planning bureau if they could always secure disinterested advice of an advisory committee of specialists and outstanding citizens. He urged, as far as possible, the co-operation of private citizens in governmental functions because of the stimulation of the interest of the citizens themselves in civic matters.

Town Planning in Saskatchewan

It is with great pleasure that one notes the progress being made in town planning matters in Saskatchewan. Since the provision of a department with an active head, there have been many indications of advancement.

There is now printed in Regina, Saskatchewan, a "Public Service Monthly" being a periodical bulletin of matters of public interest in Saskatchewan—the first issue appeared in August, 1921. Matters of town planning interest are dealt with, especially in the September issue. A review of the work of the Town Planning Branch of the Provincial Department of Municipal Affairs for the past year, shows that a large number of plans were prepared and that many communities are co-operating with the new branch of the Department of Municipal Affairs. W. A. Begg, A.M.E.I.C., is the director of town planning in Saskatchewan.

Zoning in the United States

The interest being taken in Zoning has been mentioned before in this column. In several cities in the United States, ordinances have been passed, controlling by districts or zones the use to which buildings may be put, their height and the percentage of lot area that may be covered by buildings, etc. By some ordinances building lines are also established.

Chas. B. Ball, in charge of zoning work for the Health Department of the City of Chicago, compiled in September of this year, a list of the cities in the United States in which zoning is being effected. Up to the present there are thirty-seven cities that are enforcing zoning ordinances. Over one-half of these ordinances have been made effective in the last year and a half. A great impetus to zoning was given by the enforcement of an ordinance in 1916 by New York City. According to Mr. Ball's list there are also 42 cities in the United States in which zoning ordinances are in progress.

In Canada it might be mentioned, that under ordinary by-law powers, the City of Westmount, Quebec, appears to have the best building restrictions in force. In Ontario recent amendments to the municipal act gave a greater permanency to zoning, especially in regard to detached single-family dwellings.

The "Commercial Urge" for Town Planning

An analysis of the recent advance in this country and the United States, in regard to town planning matters would indicate that business men and business organizations have been largely responsible for any such advance

As town planning is a community matter his interests are naturally broadened and his views on the subject of town planning are expressed in a wider manner than that of self interest.

An example of this will be found in the Downtown Association of Toronto, an association of business men who are engaged in many activities that will be of benefit to the community. In their work they have asked the assistance of technical organizations by the appointment of representatives to assist in committee work relating to town planning. The respective representatives from the following organizations—The Ontario Town Planning and Housing Conference, The Toronto Civic Guild, The Toronto Branch of the Town Planning Institute of Canada and the Toronto Branch of *The Engineering Institute of Canada* include the following corporate members of *The Institute*—J. P. Hynes, A. E. K. Bunnell, N. D. Wilson, and H. L. Seymour.

Town Planning at Sault Ste. Marie

According to information received from F. Theo. Gnaedinger, A.M.E.I.C., Secretary-Treasurer of the Sault Ste. Marie Branch, it is evident that the members of this Branch intend to take an active interest in the development of their city. A committee has been appointed to take action in town planning matters, with particular reference to Sault Ste. Marie.

Preliminary Notice

of Applications for Admission and for Transfer

21st November, 1921

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate member a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in December, 1921.

FRASER S. KEITH, Secretary.

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*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option, Railway, Municipal Hydraulic, Mechanical, Mining or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council He shall not remain in the class of Junior after he has attained the age of thirty-three years

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects. Geography. History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits cientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

> The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BELL—JOHN FAWCETT, of 316 St. George Street, Toronto, Ont. Born at Carlisle, England, July 10th, 1875; Educ, 1st class B of T. cert., 1st class cert., torpedo work, electricity and hydraulics, City and Guilds Tech. Coll., London, 1897-98. Private tuition during ap'ticeship by civil engr. 1890-96, ap'ticeship with Messrs. Cowans, Sheldon Ltd., Mech. Steam, Elect. and Hydraulic Engrs., Carlisle; Entered Royal Navy by competetive exam. July 1898 and granted prof. cert. and commission as eng sub lieut; 1898-1901 asst engr., H M Ships on North American Station; 1901-04, senior engr., H M Ships as Eng Sub. Lieut., and Eng Lieut on North American Station; 1904 (Apr.-Nov.), asst to the engr overseer (Admiralty) for London district; 1904-05, engr in charge torpedo depot Bermuda, 1905-08, in submarine service as lecturer and instructor, charge of workshops, power plants, etc., 1908-10, engr in charge of river gunboats, Upper Yangtse River, China, 1910-15, lent to Canadian Govt., chief engr., H M C S Niobe, 1912-15, (war service) Promoted Engr Lt Commander; 1916-18, principal and Consltg engr officer on staff of Vice-Admiral commanding 10th cruiser squadron on war service. Promoted Engr Commander, April 1916; 1918-20, consltg and advisory engr on staff of Ministry of Shipping London, (Transport Dept.); August 1920 to date, lent to Canadian Govt Commander Engr in charge of H.M.C.S. Aurora and as fleet engr. officer.

References: C. E. W. Dodwell, N. A. Yarrow, G. L. Stephens, R. H. Wood, D. G. Anglin, F. H. Grose, G. S. Stairs.

BISHOP—ARTHUR DALE, of 711 Langlois Avenue, Windsor, Ont. Born at Worcester, Mass., U. S. A., April 1st, 1896; Educ., B.S. in C.E. Univ. of Vermont, 1919; 2 courses in advanced struct'l design. Special course in dfting.; rodman, Connecticut River Survey; rodman, dftsman and instr'man, on city engr'g. work; 1919 (June-Aug.), instr'man for Federal Aid Road Survey Work; 1919 (Aug.-Dec.), insp'r. in charge of laying out and building highway on Federal Aid Project No 10 for State of Vermont Engr'g. Dept.; At present dftsman. on structural steel including detailing and estimating for bridges, buildings, towers and viaducts., Canadian Bridge Co. Ltd., Walkerville, Ont.

References: A. J. Riddell, G. F. Porter, C. M. Goodrich, S. E. McGorman, F. H. Kester, G. V. Davies, A. B. Richardson.

BROWN—CHARLES WALTER, of 36 High Street, St. John, N.B. Born at St. John, N. B., Sept. 26th, 1893; Educ., B.Sc. (C.E.). Univ. New Brunswick, 1914 4 mos. gen. study, University of Glasgow, 1919; 1911-12 (summers), student engr., Dept. P.W. Canada, West St. John, N.B.; 1913 (summer) and 1914-15, asst. engr., Dept. P.W. Canada, West St. John, N B.; 1915-19, overseas; 1919 (May-Aug.), asst. engr. Dept. P.W. Canada, on Courtenay Bay Development, under A. Gray; At present, engr., J. A. Grant & Co. Ltd., Engrs. and Contractors, St. John, N.B.

References: A. R. Crookshanks, J. A. W. Waring, A. Gray, J. A. Grant.

BUCHANAN—EDWARD VICTOR, of London Ont. Born at Hamilton, Scotland, May 7th, 1887; Educ., elect'l engr.g., Royal Tech. College, Glasgow, 1908; Ap'ticeship, Marshall Fleming and Company, Motherwell, Scotland; 1908, asst. engr., laboratory, Glasgow Corpn., electricity dept.; 1909-10, asst. engr., Sayers and Caldwell, Consltg. Engrs., Glasgow; 1910, asst. engr., H. J. Glarbitz, Consltg. Engrs., Toronto; 1911, appointed electrical and Waterworks engr., City of London, Ont. 1915 to date, gen. mgr., Public Utilities Commission, London, Ont.

References: F. A. Gaby, W. J. Francis, E. T. J. Brandon, H. A. Brazier, H. B. R. Craig.

BURY—BERTRAM EDWARD, of Box 489, Edmonton, Ata. Born at Bournemouth, England, Dec. 21st, 1876; Educ., Univ of Liverpool, 1896; 1896-98, ap'tice, Messrs. C and A. Musker, Hydraulic Engrs., Liverpool, England, and in drawing office, 1898; 1898-1900, constrn. staff, Entre Rios Rly. Co., Argentine; 1900-07, mtce., constrn., location and surveys, Buenos Ayres Western Rly.; 1907-11, contracting on drainage, irrigation and surveying, in Argentine, Paraguay and Uraguay; 1912-13, dftsman., constrn. dept., C.L.O. and W. Ry. (C.P R.), Newcastle, Ont.; 1918, location survey Edmonton, Dunvegan, and B.C.Rly.; 1918-19, instr'man., mtce. dept., G.T.P.-Ry., Edmonton; 1920, district engr., Prov. Govt. of Alberta; At present, instr'man., Lesser Slave River Survey, Public Works Dept., Dom. Govt.;

References: C. C. Sutherland, L. C. Charlesworth, G. C. Dunn, R. P. Graves, R. W. Ross.

BUTT—ROBERT EDWARDS, of 17 West Avenue South, Hamilton, Ont. Born at Birmingham, England, Feb. 8th, 1886; Educ., 1904-07, afternoon and evening classes, Birmingham Munic. Tech. School, and ap'ticeship, engr'g. works, Gen. Elec. Co. Ltd, Birmingham, England; 1908-11, mech. dftsman., Siemens Bros., Dynamo Works Ltd., Stafford, England; 1912, machinist, Gaol Square Motor Co. Ltd., Stafford, Eng., and A.B.C. Motor Co. Ltd., Vancouver, B.C.; 1912-14, asst. to bridge engr., city Engr's. dept., Vancouver, B.C.; 1915-17, machinist, mtce. dept., Kynoch Limited, Witton, Birmingham, England; 1917 (Apr.-Nov.), asst. plant engr., Sterling Tel. & Elec Co. Ltd., Pagenham, Essex, England; 1917-20, foreman, mach., repair and equipment dept., Cosmos Engr'g. Co. Ltd., Bristol, England; At present, sftsman., Can. Westinghouse Co. Ltd., Hamilton, Ont.

References: A. G. Dalzell, H. D. Dwight, W. H. Powell, W. F. McLaren, H. U. Hart, P. Philip,

CADWELL—MARCUS DOW, of North Battleford, Sask. Born at Hawkesville, Ont., May 26th, 1880; Educ., grad. I C S steam and electrical Engr'g.; 1895-99, steam engr., Waterloo, Ont; 1900-08, steam-elect. engr., Qu'Appelle, Sask.; 1909, steam-elect. engr., Prince Albert; 1910-15, steam-elect. engr. and from 1915 to date, city engr., North Battleford, Sask. Also supt of municipal utilities.

References: D. A. R. McCannel, G. W. Craig, J. D. Peters, J. W. Calder, G. D. Mackie.

FARNCOMB—FREDERICK WILLIAM, of 307 Dominion Savings Building, London, Ont. Born at Newcastle, Ont., Feb. 13th, 1867; Educ., Hellmath College and Dufferin Military College, London, Ont. 4 years ap'ticeship, Peters and Jones, Surveyors Engrs. and Arch'ts., and passed final exam. for O.L.S. 1899; 1899 to date. general practice, including surveying, municipal engr'g. and consltg. engr'g.

References: H. B. R. Craig, W. Chipman, W. A. Bucke, H. A. Brazier, J. A. Bell, F. A. Bell, H. J. Lamb.

FISK—HAROLD BELBIN, of (Box 202) Drummondville, Que. Born at Evesham, England, July 12th 1883; Member A.I.E.E.; Educ., Kings College, London, England. 4 years pupil with Baily, Grundy and Barrett, Elect'l and Mech. Engrs., Cambridge, England; 1906-07, junior engr., representing above firm in the east of England for Elect'l. Constrn. Co. of Wolverhampton; 1907-10, with The Shawinigan Water & Power Co. as:—operator in Montreal Terminal Station (3 mos.), asst. engr. in chief engr's. office, Montreal, and in the constrn. office at Shawinigan Falls; 1910-12, with The Mines Power Co. (now Northern Ontario Power Co.) at Cobalt, as asst. to gen. supt., and later supt. of generating station at the Matabitchouan River development. This included constrn. and operating work; 1912-13, with Shaw. Water & Power Co. at Shawinigan Falls, as asst. to elect'l. constrn. supt., and later as mech. engr. in charge of install'n. of equipment in No. 2 Gatehouse; 1914-16, with Kaministiquia Power Co., Fort William, Ont., as engr. in charge of elect'l equipment, and asst. to mgr. during publicity campaign to attract additional industries to the Head of the Lakes; 1916-21, with Southern Canada Power Co., Montreal, as plant supt., and later as divn. supt. with headquarters at Drummondville; At present, Gen. Mgr., Walsh Plate and Structural Works Ltd., Drummondville.

References: L. N. Jenssen, J. M. Robertson, C. J. Desbaillets, J. Ruddick, F. W. Teele, A. R. Henry, W. Maclachlan, F. T. Kaelin.

FRANZ—WILLIAM CHARLES, of Sault Ste. Marie, Ont. Born at Bucyrus, Ohio, U.S.A., March 14th, 1871; President, Algoma Steel Corporation, Sault Ste. Marie, Ont.

References: A. W. Sinnamon, R. S. McCormick, K. G. Ross, W. J. Fuller, C. M. Macreath.

GARNEAU—JEAN B., of Quebec, Que., Born at Quebec, Oct. 29th, 1890; Educ., Bach. in Surveying, Laval Univ., 1912; 1911, rodman, Quebec Saguenay Rly.; 1912-13, in charge of a surveying party; 1913-15, in charge of a constrn. divn. on the Montreal-Quebec Highway; 1915 to date, chief of laboratory for testing materials, Dept. of Highways, Provincial Govt.

References: G. Henry, A. Fraser, R. J. L. Savary, J. P. P. Joncas, T. E. Rousseau, J. A. Lefebvre, A. Lariviere, J. E. Roy.

GIFFORD—F DARRELL, of 333 Burnham Street, Peterborough, Ont. Born at Port Hope, Ont.,.Nov. 3rd, 1889; Educ., 4 years private study, engr'g subjects; 1910, constrn. work, Fraser Divn., C.N.P.Rly.; 1911, levelling, transit work, office work, etc., practically acting res. engr., North Thompson River Divn., C.N P.Rly.; 1912, in charge of above section, C.N.P.Rly.; 1913-14, Forestry Branch, B.C. Govt.; 1914, constrn. work, and later lumber and tie inspr., P. & G.E.Rly.; 1915-19, overseas. Major, M.C.; Appointed industrial surveyor, vocational branch, D.S.C.R., later re-training inspr., and at present, district vocational officer in charge of Peterborough District, Headquarters, Peterborough.

References: R. M. Taylor, W. C. McLaren, A. A. Richardson, R. L. Dobbin.

GOODWIN—WILDER CLIFFORD, of East St. John, N.B. Born at Belle Isle, N.S., June 19th, 1892; Educ., cores. courses and private study in civil and struct'l. engr'g.; 1911-12, rodman, C.P.R., mtce. of way.; 1912 (Aug.-Oct.), rodman and levelman, G.T.P.; 1913-14, dftsman City of St. John; 1914-19, overseas. C.F.A. Gained commission; Aug. 1919 to date, field engr., St. John Dry Dock & Shipbuilding Company.

References: A. R. Dufresne, E. G. Cameron, G. N. Hatfield, V. S. Chestnut, A. Gray, H. D. Macauley.

GRAHAM—JOHN HENRY, of Box 587, London, Ont. Born at Ottawa, Ont., Oct. 1st, 1889; Educ., Matric. Ashbury College, Ottawa; 1911-12, asst. engr., constrn. of Quinze Dam, in charge of removal of shoals in River St. Lawrence mid.-channel; 1912-13, asst. engr. in charge of borings Kingston harbour; 1913 (summer), instr'man, surveying Rainy River; 1913-14, surveying Lake Nipissing; 1914 (summer), surveying Frech River; 1915-19, overseas; 1920-21, removal of shoals at Sarnia and Point Edward; At present, junior engr., D.P.W. Canada, London.

References: H. B. R. Craig, W. J. Forbes-Mitchell, A. J. Steeves, S. J. Chapleau, C. R. Coutlee, S. B. Johnson, A. M. Kirkpatrick, D. W. Jamieson.

GRANT—DONALD ERNEST, of 298 St. James Street, Montreal, Que. Born at Walbottle, North'land, England, March 18th., 1884; Educ., 1 term Leeds Univ., England; 1899-1905, engr'g. training, John Spence & Sons, Newburn Steel Works; 1905-06, John Fowler & Co., Leeds, traction engines; 1906-07, Henry Berry & Co., Leeds, Hydraulic Engrs.; 1908, Fairfield Shipbldg, Co., Glasgow, on marine engines; 1908-09, head dftsman. on high speed engines and air compressors, Alley & McLellan, Glasgow; 1909-10, commercial engr. in charge, on tin mining and rubber plants, Riley Hargreaves & Co. Ltd., Singapore; 1911, mgr., Newgate St. Iron & Steel Works, Worksop, England; 1911-14, works engr., Cammell Laird & Co. of Sheffield & Penistone, England; 1914-19, military service, 1914-16, built a rly into desert from El. Ferdan on the Suez Canal. 1917-18, director, forgings. castings & tampings, Ministry of Munitions, London; 1919-20, asst. mgr., commercial Dept., Messrs. Sir W. G. Armstrong Whitworth & Co. Ltd., of Newcastle, Manchester & London, England; At present, control of all the activities of the Armstrong group of firms in North America.

References: J. H. Hunter, R. Bickerdike, V. I. Smart, A. Surveyer, A. H. Ross.

IGOL—FRANCIS JOSEPH, of 296 Stewart Street, Peterborough, Ont. Born at Watervliet, N.Y., Feb. 15th, 1899; Educ., chem. engr., Rensselaer Polytechnic Institute, 1920; rodman on constrn. of reservoir for city of Watervliet; At present, chemist for the Canadian General Electric Co. Ltd.

References: L. DeW. Magie, D. L. McLaren, A. B. Gates, P. L. Allison, G. R. Langley.

LAWRENCE—JOHN FRANK, of Grand Mere, Que. Born at Hantsport, N.S., May 20th, 1886; Educ., B.Sc., McGill Univ., 1913; 5 years machine shop practice; 2 years, marine engr., securing engr's. cert. for ocean going vessels; 1913-19, with The Canadian Fairbanks-Morse Co. Ltd., Montreal—the last two years as mgr. of mach. dept.; 1919 to date, supt. of shops, Laurentide Company Ltd., Grand Mere.

References: R. L. Weldon, H. O. Keay, J. J. O'Sullivan, A. R. Roberts, C. Batho.

MAXWELL—GEORGE DEAN, of 233 Albany Avenue, Toronto, Ont. Born at St. Stephen, N.B., Sept. 13th, 1892; Educ., B.A.Sc. (Honours), Univ. of Toronto, 1921; 1909-13 (summers), rodman, bridge inspr. etc., C.N.P.Ry.; 1915-16, rodman, Toronto Harbour Commn.; 1917 (Feb.-Apr.), timekeeper, Jackson Lewis Co.; 1917-18, timekeeper, material clerk, storekeeper, Imperial Munitions Board; 1918-19, asst. res. engr., aviation constrn. dept., Imperial Munitions Board; 1920 (May-July), timekeeper, Norman McLeod Ltd.; 1920 (July-Oct.), engr. in charge of city pay rolls and materials, Norman McLeod Ltd., 1921 (May-Sept.), concrete inspr., H.E.P.C.: At present demonstrator in drawing, Faculty of Applied Science and Engineering, Univ. of Toronto.

References: C. R. Young, W. J. Smither, N. McLeod, J. R. Cockburn, J. B. Carswell.

McINTYRE—GORDON, of Regina Sask. Born at Montreal, Que., Jan. 16th, 1895; Educ., B.Sc. (Chem. Engr'g.) McGill Univ., 1921; 1912 (summer), elect'n. for Henry Morgan Co.; 1913 (summer), on north railway survey; 1914 (summer), engr. on a yacht; 1914-19, overseas. C.E. and R.A.F.; 1920 (summer), plant research and efficiency work, Standard Chemical Co.; At present, chemist in charge of testing and research laboratories, Imperial Oil, Limited, Regina. Also combustion engr. and in charge of efficiency work in connection with chemical operations in plant.

References: C. M. McKergow, H. M. Lamb, E. Brown, J. B. Porter, E. A. Duschak.

McKEAND—DAVID LIVINGSTONE, of 157, Beuno Vista Road, Rockcilffe, Ottawa, Ont. Born at Hamilton, Ont., July 1st, 1879; Educ., Trinity College School, Port Hope, Ont. 1895; 1895, entered Bank of Hamilton, Hamilton, Ont., 1906-10, mgr., Mitchell, Ont., 1910-15, Midland, Ont.; 1899-1909, with Can. Contingent in South Africa; 1915 and 16, overseas. Lieut. promoted to Major. Wounded 1916; 1917-21, officer paying Can. pensions, Dom. Govt. Services; At present asst. director. Northwest Territories and Yukon, Dept. Interior, Ottawa. Member, Board of Hearing and Recommendation, Civil Service Commission, since 1919.

References: O. S. Finnie, A. St. Laurent, W. F. M. Bryce, C. P. Edwards, C. R. Coutlee, C. V. Putman, K. M. Cameron.

McLEAN—DONALD MINTO, of Sherbrooke, Que. Born at Brompton, Que., Feb. 11th, 1866; Educ., corres,. schools and private study; 1896-98, special statistical and acctg. work, Can. Rand Drill Co., and Jenckes Machine Co.; 1898-1905, Jenckes Machine Co., Sherbrooke, Que. advertising and catalogue work, engr.-salesman, specializing on water power surveys and estimates and prelim. design. 1905, asst. sec., above firm. at Sherbrooke, and from 1906-11, sec. and engr. of St. Chatharines, Ont. Branch of above firm; 1911-12, sales and advertising mgr., L. & I. J. White Co., Buffallo, N.Y.; 1912-13, efficiency engr. and 1913-16, chief engr., Dover Boiler Works, New York City and Dover, N.J.; 1917-20, publicity mgr., Can. Ingersoll-Rand Co. Ltd., Sherbrooke, Que.,; 1920-21, investigating and liquidating G. &. G Limited, Rock Island, Que.; 1921 (July-Sept.), conducting an advertising service, Sherbrooke, Que.; At present with Dom. Engr'g. Works, Ltd. on special work in connection with preparation of printed matter on their products.

References: H. V. Haight, S. R. Newton, E. T. Spidy, H. C. Nourse, A. F. Hanly.

SCOTT—WILLIAM GORDON, of 123 Westminster Avenue North, Montreal West, Que. Born at Valleyfield, Que., Dec. 19th, 1886; Educ., B.Sc., McGill Univ., 1908; 1908-09, constrn. dept., 1909-10, foreman of test dept., 1910-13, erecting engr., Allis Chalmers Bullock, Limited; 1913-14, head electrician, Maple Leaf Milling Co. Ltd., Port Colbourne, Ont.; 1914-18, elect'l engr., plant dept., and 1918 to date, plant engr., Northern Electric Company, Montreal.

References: J. S. Cameron, W. H. Eastlake, J. C. Day, G. P. Cole, G. E. Templeman, L. A. Kenyon.

SWAYZE—RUSSELL WESTLAKE, of 24 Stanely Street, London, Ont. Born at London, Ont., Feb. 11th, 1898; Educ., London Collegiate Institute; 1913-15, junior dftsman, Public Utilities Commn. and appointed head dftsman in 1916 with Public Utilities Commn. to dare, in charge of design and supting. constrn. of various works.

References: H. B. R. Craig, W. J. Shaw, H. S. Philips, J. R. Rostron, W. E. Stephens.

SUTHERLAND—DUNCAN GAIR, of 925 Sherburn Street, Winnipeg, Man. Born at Bradley, Staff., England, Sept. 12th, 1882; Educ., West Bromwich and Birmingham Science and Arts Institute; 1898-1904, articled to Messrs. Tangyes, Ltd., Birmingham; 1904-06, dftsman and asst. designer, Lee Howl & Co., Staff. England.; 1906-07, estimating engr., The Pakometer Engr'g. Company, Reading, England; 1907-12, dftsman and asst. office and field engr., City of Winnipeg Power Constrn. Dept.; 1912-13, industrial engr., and 1913-16, designing engr., City of Winnipeg Light & Power Dept.; 1916 to date, contracting engr., Winnipeg Electric Rly. Company.

References: G. L. Guy, E. V. Caton, W. M. Scott, W. P. Brereton, F. H. Martin.

VEITCH—WILLIAM MARTIN, of London, Ont. Born at Duns, Berwickshire, Scotland, March 24th, 1888; A.M.I.C.E. London, England, 1914; Educ., grad. in civil engr'g., Royal Tech. College, Glasgow; 1907-12, articled pupil to Messrs. Warren and Stuart, Glasgow, Scotland; 1901-12, asst. engr. on Clyde bank water works; 1913, in charge of design and constrn. of reinforced concrete tank and pipe lines for water supply of Symington, Scotland; 1913-14, in charge of design of storm sewers for West Toronto Divn., City of Toronto; 1914-19, overseas. Lieut., R.E., 1919-20, in charge of industrial survey for D.S.C.R. for London District; At present, special asst. in charge of design of sewers and disposal plants for city of London, Canada.

References: H. A. Brasier, W. R. Werthington, H. S. Philips, E. R. Gray, R. R. Knight.

WEIR—JAMES, of Montreal, Que. Born in Manitoba, May 8th, 1883; Educ., B.Sc. (C.E.) McGill Univ., 1913; 1909-12 (summers), minor positions on land and city surveys and munic. works; 1913-18, demonstrator and lecturer, and diring 1918, sole instructor, surveying dept., and from 1918 to date, supt. of McGill Observatory and from 1919 to date, asst. professor of geodesy and surveying, McGil lUniversity, Montreal.

References: H. M. MacKay, E. Brown, C. M. McKergow, C. V. Christie, R. DeL. French.

WESTON—SAMUEL RAYMOND, of 83 Parks Street, St. John, N.B. Born at Upper Gagetown, N.B., May 15th, 1889; Educ., B.Sc. in C.E., Iniv. of N.B., 1914; Deputy Crown Land Surveyor, Prov. of N.B., 1915; 1910 (summer), rodman and instr'man., Gibson-Minto Rly.; 1911 (summer), stident asst., D.P.W., Chatham, N.B.; 1912-13 (summers), surveying for N.B.Rly.Co., 1914, dftsman., rly. location, Eastern Maine Rly. Co.; 1915-16, partner in firm, Colter and Weston, Fredericton, general surveying and small engr'g works; 1916 (May-Sept.), transitman, location survey, St. John and Quebec Rly.; 1916-18, res. engr. in charge of constrn., Sy. John and Quebec Rly.; 1918-19, mgr. for Midland Coal Co. Ltd. at Salmon Harbour, N.B.; 1919-20, private practice, surveying and engr'g.; April 1920 to date, asst. chief engr., N.B. Electric Power Commn., St. John, N.B.

References: C. O. Foss, C. H. Mitchell, B. M. Hill, H Phillips, K. H. Smith, D. F. Maxwell, J. A. Stiles, H. Holgate.

WILSON—KELTIE, of 43 Wright Street, St. John, N.B. Born at St. John, N.B., Feb. 21st, 1892; Educ., private stydy; 1912-13, rodman, topog'r. leveller, St. John and Quebec Rly. and Aroostook Valley Rly.; 1913-16, chief inspr., in charge of dredging and rock insprs., Courtenay Bay Development, St. John Harbour, and 1916 to date, instr'man., making surveys before and after dredging, complete survey of St. John Harbour, etc., Dept. Public Works of Canada.

References: A. Gray, F. P. Vaughan, A. G. Tapley, S. B. Wass, E. G. Cameron.

WINSLOW—KENELM MOLSON, of 136 Middle Gate, Winnipeg, Man. Born at Stratford, Ont., Jan. 20th, 1898; Educ., B.Sc., McGill Univ., 1916 (Apr.-June), machinist, Canadian Ingersoll-Rand Co., Sherbrooke; 1916-19, overseas. Lieut., Can. Engrs.; At present, dftsman., motive power and car dept. C.P.R., Winnipeg.

References: H. M. MacKay, E. Brown, C. M. McKergow, A. R. Roberts, J. B. Porter, H. M. Lamb, E. P. Fetherstonhaugh, E. S. Winslow.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

HORNE—EWART GLADSTONE, of Montreal Que., Born at Lowell, Mass., U.S.A., Oct. 7th, 1888; Educ., B.A. Dartmouth Univ., 1912; 1904-07, Boston and Maine R.R.; 1912-13, engr., Aberthaw Constrn. Co.; 1913-15, engr., E. G. M. Cape & Co. Ltd.; 1915-19, partner, Grant and Horne, St. John, N.B. constrn. contracts, also bldg. wooden steamers for Imperial Munitions Board; 1919, mgr., Lockewood Greene & Co. of Canada Ltd., Montreal, and from 1920 to date, vice-pres. and Managing director of same firm.

References: F. B. Brown, W. J. Francis, A. Gray, G. L. Mattice, E. S. Mattice, F. S. Keith.

LEONARD—IBBOTSON, of London, Ont. Born at London, Ont., July 30th, 1882; Member, Amer. Soc. Mech. Engrs.; Educ., Grad. with honours, R.M.C., Kingston, 1903; B. Sc., McGill Univ. 1905; 1902-04 (summers), dftsman room and shop, E. Leonard & Sons Ltd., London; 1905 to date (with exception of 1914-1918, when overseas), with E. Leonard & Sons Ltd., London, Ont., 1905-12, boilershop supt., and from 1919 to date, vice-pres. and gen. mgr.,

References: G. A. Walkem, R. J. Durley, H. B. R. Craig, H. A. Brazier, H. L. Trotter, C. H. Mitchell, H. J. Lamb.

TOWNSEND—CHARLES JOSEPH HARRISON, of 90 Grenadier Road, Toronto, Ont. Born at London, Ont., April 19th, 1885, Educ., B.A.Sc. '05, C.E. '17, Univ. Toronto; 1905-06, dftsman., Can. Foundry Co., Davenport, Ont.; 1907, checker and designer, McMyler Mfg. Co., Cleveland, Ohio; 1908-09, asst. to mech. engr., The Arnold Co., Engrs. and Constructors, Chicago; 1910-11, design, constrn. and install'n. of Mach., Federal Brass Works, Chicago; 1911-12, mech. engr., Federal Brass Works and Liquid Carbonic Co., Chicago; 1912-14, Member of firm, Wilson, Townsend and Saunders, Moose Jaw, Sask., constrn. reinforced concrete structures etc.; 1914-18, contract work under own name; 1917-19, chief engr., Dom. Shipbldg. Co., Toronto; 1919-20, member of firm, Russell-Townsend Co.; At present member of firm, Russell Constrn. Co. Ltd. and mgr., Drifting Sand Filter Co. Ltd., Toronto.

References: O. T. Clark, W. J. Francis, E. R. Gray, P. Gillespie, A. H. Harkness, R. O. Wynne-Roberts, R. H. Parsons, G. A. McCarthy.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

ANDERSON—ALEXANDER ALDERSON, of Box 587, London, Ont. Born at Ottawa, Ont., Sept. 23rd, 1889; Educ., Grad. R.M.C. Kingston, 1909; B.Sc. McGill Univ., 1911; 1901 to date (with the exception of 1914-19 when overseas with Can. Engrs.) with Dept. P.W. as follows.:—1910 summer and 1911-12, current meter work, 1912(Mar-May), asst. on constrn., Temiskaming Dam, Upper Ottawa Storage Works, 1912-13, in charge of current meter work and survey parties, 1913-14, in charge of reconnaisance, design and constrn. of dam at Big Chaudiere Falls on French River, and July 1919 to date, asst. engr. chief engr's. branch, London District.

References: H. B. R. Craig, C. R. Coutlee, S. J. Chapleau, S. B. Johnson, W. P. Anderson, W. E. Blue, W. J. Forbes-Mitchell.

BOESE—PAUL RAYMOND, of Box 413, Ely, Nevada, U.S.A. Born at Hartlebury, England, Aug. 7th, 1882; Educ., 3 years Queen Elizabeth's School, and 2 years King James School, England. Articled pupil to C. Auden, A.M.I.C.E., Glasgow, 2 years; 1900-02, dftsman., Birmingham Corpn. Water Supply; 1904-06, asst. engr., Alto Minho and Valle De Lima Rly., Braga, Protugal; 1907-09, surveys and constrn.; 1910-13, res. engr., Southern New England Rly.; 1913-14, res. engr., double tracking, C.P.R.; 1914, supt. of constrn., Scott & Hulme, Contractors, Buenos Ayres; 1915-17, asst. engr., Nevada Northern Rly., federal valuation, mtce. and constrn., in charge of all field work; 1917 to date, chief engr., Nevada Northern Rly.

References: D. Hillman, A. McCulloch, H. L. Sherwood, G. P. F. Boese, W. H. McGaan, A. S. Going.

BRADLEY—CLAUDE, of 4024 Triumph Street, Vancouver, B.C. Born at Bradford, England, Oct. 10th, 1886; Educ., Evening classes, Schools of Technology, Harrowgate, Bradford and Manchester, England; 1902-05, served under articles with J.C. Clark, arch't. and Surveyor, Harrowgate; 1905-08, dftsman., engr'g. dept., Bradford Dyer's Assn.; 1908-11, asst., engr'g. dept., Bleacher's Assn., Manchester, Eng.; 1912 (May and June), dftsman., Harrison & Ponton, Surveyors, Calgary, Alta.; 1912-13, dftsman, townsite branch, D.N.R., C.P.R., Calgary; 1913-17, chief dftsman, in above office, in charge of all dfting graphic records and publicity maps and 1917-20, asst. surveyor for some office; 1921 (Feb. and March), engr., Brooks, Bidlake and Whittall, Shingle Mfrs., Vancouver, B.C.

References: D. T. Townsend, B. L. Thorne, W. Pearce, J. B. Riddall, F. W. Alexander, R. Snodgrass, J. N. Anderson.

IRVING—JAMES C., of Deloraine, Man. Born at Winchester, Ont., April 15th, 1894; Educ., B.C.E. Univ. of Manitoba, 1915; 1912, city engr's. dept., Moose Jaw, Sask.; 1913-14 (summers), rodman, Moose Jaw Electric Rly.; 1915, mtce. of way, G.T.P.R.; 1916-19, overseas; 1919 (Apr.-Sept.), instr'man., mtce. of way, C.P.R.; 1919-20, asst. engr., Good Roads Board, Winnipeg; Sept. 1920 to date, district engr., Good Roads Board.

References: M. A. Lyons, W. H. Hunt, E. P. Fetherstonhaugh, E. E. Brydone-Jack, J. N. deStein, P. Burke-Gaffney,

KELLY—ALBERT JOHN, Montreal, Que. Born at Edmonton, Alta., May 15th, 1888; Educ., B.Sc., McGill Univ., 1911; 1909-10, Crown Land Surveys; 1910-11, rly. location; 1911-16, demonstrator and lecturer, McGill Univ.; 1916-19, overseas. Lieut.; 1919-date, asst. professor of surveying and head of the dept. of surveying and geodesy, McGill University.

References: H. M. MacKay, C. M. McKergow, E. Browm, H. M. Lamb, J. B. Porter.

MORRISEY—HENRY FAIRWEATHER, of 58 Hazen Street, St. John, N.B. Born at St. John, N. B., June 14th, 1890; Educ., B.Sc. Univ. of New Brunswick, 1912; M.Sc., 1915; 1909-11 (summers), P.W.D., St. John, N.B.; 1912-20 (with exception of time with Imperial Navy, attached to the hydrographic branch), asst. engr. on River St Lawrence Ship Channel; July 1920 to date, district engr., Marine Dept., St. John, N.B.

References: F. A. Wise, A. Lafleche, F. S. Jones, F. G. Goodspeed, H. F. Bennett.

STENHOUSE—RONALD HARROWER, of 265 Slater Street, Ottawa, Ont. Born at Dunfermline, Scotland, Dec. 12th, 1887; Educ., Passed 1st part B.A. Degree, Pembroke College, Cambridge; 1909 (summer), on constrn. C.N.R.; 1910-14, with C.P.R. as follows, 1910-11, rodman on constrn., 1911-13, instr'man, on constrn., 1913-14, res. engr. on constrn. of double tracking, Lake Superior Divn.; 1914-15, overseas; 1915-16, gen. mtce. work, C.P.R.; 1916-19, overseas with C,R.T. and C.O.R.C.C.; 1919-20, transitman, mtce. of way, C.N.R.; 1920 (Feb.-Nov.), custodian of surveying equipment, topog'l surveys, Dept. of the Interior; Nov. 1920 to date, senior dftsman., reclamation service, Dept. of the Interior, Ottawa.

References: F. H. Emra, A. V. Redmond, W. T. Moodie, W. O. Cudworth, G. F. Richan, H. L. Sherwood, H. R. Cram, W. C. Gillis, H. W. Ault.

VROOM—HAROLD HEARD, of 42 Oak Avenue, St. Lambert, Que. Born at St. Stephen, N.B., Sept. 23rd 1887; Educ., B.Sc., McGill Univ., 1910; 1910-11, engr'g. dept., National Electric Lamp Assn., Cleveland, Ohio; 1911-12, illuminating engr. and salesman, Canadian Sunbeam Lamp Co., Toronto.;1912-15, dfting and engr'g work on mech. and elect'l equipment of bldgs., engr'g. Dept.., Ross and Mc Donald, Arch'ts., Montreal; 1915-16, plant dept., Northern Electric Co., Montreal; 1916-19, Sub.Lieut. and Lieut. R.N.V.R., Overseas Services; 1919-21, plant engr'g. dept., Northern Electric Co., Montreal, in charge of methods, design of factory illumination, exhaust systems and special power plant studies. At present investigating manufacturing costs, for above company.

References: J. S. Cameron, J. H. Trimingham, E. A. Ryan, R. DeL. French, E. Vinet, J. C. Bay.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

ELDER—JOHN CAMPBELL, of 300 Notre Dame Street West, Montreal, Que. Born at Montreal, Que., Feb. 21st, 1899; Educ., B.Sc. (Civil) eGill Univ. 1921; 1917 (summer), struct'l. dftsman., Dom. Bridge Co.; 1918 (summer), Can. Engrs. Officer's Training Class; 1920, Gen. Combustion Co. of Canada, designing, and estimating industrial oil burning furnaces; 1921 (summer), inspr. of roads sidewalk constrn., Town of Montreal West; At present salesman for J. A. Elder.

References: H. M. MacKay, E. Brown, D. C. Tennant, A. Peden.

FRITH-LAWRENCE EDWARD COKAYNE, of 513 McDermot Ave., Winnipeg, Man. Born at Winnipeg, Man., May 1st, 1893; Educ. B.A. (Math.) 1913, B.Sc. (E.E.)|1921, Univ. of Manitoba; 1911 (July-Sept.), survey party,C.P.R.; 1912-14, electr'l helper, various firms; 1915-16, asst. operator, May St. sub-station, City of Winnpeg Light & Power Dept.; 1920 (May-Sept.), plant record dept., and from July 1921 to date, plant record dept. and electrolysis survey, Manitoba Govt. Telephones.

References: E. P. Fetherstonhaugh, J. N. Finlayson, G. L. Guy, J. A. Hesketh, J. W. Dorsey, A. C. Frith, N. M. Hall., R. W. Moffat.

GLOVER—THOMAS STANLEY, of 569 Spadina Avenue, Toronto, Ont. Born at Hull, England, August 10th, 1894; Educ., 4th year student, Faculty of Applied Science, Univ. of Toronto; 1913 (Apr.-Sept.), inspr., highways dept., City of Toronto; 1914 (Apr.-Aug.), dftsman., highways dept., Ont. Govt.; 1914-19, overseas; 1919 (May-Sept.), highways dept., Ont. Govt.; 1920, helper to layer out, McGregor & McIntyre, Toronto; 1921, hydraulic engr. at St.Anthony, Nfld. for International Grenfell Assn. to investigate and report on the provision of water power for St. Anthony; At present, preparing report, and doing 4th year work at Univ. of Toronto.

References: C. H. Mitchell, W. A. McLean, J. R. Cockburn, P. Gillespie, T. R. Loudon, C. R. Young.

MACDONALD—ALBERT EDWARD, of Halifax, N.S. Born at Halifax, N.S., Feb. 20th, 1900; Educ., B.Sc. (C.E.) N.S. Tech. Coll.,1920-1917(summer), dftsman, rodman, concrete inspr., bridge dept.,Halifax Ocean Terminals; 1918 (summer), dftsman, instr'man and concrete inspr., with above.; 1919 (summer), inspr. for town of Stellarton on constrn. of $1000,000 contract, pavements; 1920 (summer), inspr. on constrn. of street pavement, City of Halifax; 1921 (summer), inspr. on constrn. of concrete sidewalk paving, City of Halifax; Session 1920-21, lecturer in civil engr'g., Univ. of Alberta; At present, studing for M.Sc. at McGill University.

References: F. I. C. Goodman, H. W. D. Doane, F. R. Faulkner, J. N. Finlayson, H. M. MacKay, R. S. L. Wilson.

MACKENZIE—BROUARD HUNTER TYNDALL, of 27 Gouverneur Street, New York, N.Y. Born at Moncton, N.B., June 9th, 1893,; Educ., Grad. R.M.C. Kingston, Ont.; B.Sc., McGill Univ., 1920; 1 year, mech. dftsman, Dominion Engr'g. Works, Lachine, Que.; Summer work on rld. and other surveys; 1915-18, overseas. Capt., C.E.F.; At present, junior engr., Coverdale and Colpitts, Consltg. Engrs., New York.

References: W. B. Mackenzie, J. Edington, M. J. Murphy, J. S. O'Dwyer, R. H. Emmerson, E. G. Evans, G. E. Bell.

MILLER—WILLIAM MILES, of Maresfield Park, Uckfield, Sussex, England, Born at Montreal, Que., Sept. 12th, 1891; Educ., grad,. R.M.C. 1912. 2 years course, School Military Engineering, Chatham, England; Went directly to France 1914, and commanded various signal companies there. 1920-21, senior engr. officer, Mil. District No. 1, and works officer, Mil. District No. 2, Canada. At present, Capt. Royal Corps of Signals, stationed at Signal Training Centre, Maresfield Lark.

References: J. H. L. Bogart, C. S. L. Hertzberg, D. M. Jemmett, F. F. Miller, W. L. Malcolm, J. Houliston, C. G. Porter, G. C. Wright.

O'HALLORAN—JAMES, of Box 100, Iroquois Falls, Ont. Born at Montreal, Que., May 27th, 1900; Educ., B.Sc. McGill Univ., 1921; 1918 (May-Sept.), asst. on Dom. topog'l survey in Cape Breton; 1920 (June-Sept.), and at persent, asst. mech. engr., Abitibi Power & Paper Co. Ltd., Iropuois Falls, Ont.

References: J. B. McRae, E. Brown, H. A. Lumsden, A. R. Roberts, C. M. McKergow.

PAUZE—LOUIS, of 1268 St. Denis Street, Montreal, Que. Born at Montreal, Jan. 29th, 1890; B.Sc. and C.E. Ecole Polytechnique, 1915; 1913, land surveying with P. E. Mercier; 1914, Dept.P.W. Sherbrooke; 1915, chief dftsman, town plans of Longue Pointe; 1915, inspecting engr., concrete constrn., Three Rivers; 1915-19, constrn. of refinery of Imperial Oil Ltd., Montreal East; 1919 to date, combustion engr., Montreal East Refinery, Imperial Oil Limited.

References: J. E. Letson, P. E. Mercier, C. C. Leluau.

ROSENORN—PAUL EMIL MATHIAS, of 55 Addington Avenue N.D.G., Montreal, Que.., Born at Fredericia, Denmark, Sept. 25th, 1882; Educ , high school, Denmark, 1898. Sschool for Officers of the Regular Army, Denmark, 1904; 1907-10, rodman, dftsman, and transitman, C.P.R. Montreal Terminals; 1910-12, transitman, double tracking, St. Lawrence River Bridge, Lachine, Que.. C.P.R.; 1912-13, constrn. of Sortin Yard, Montreal, C.P.R.; 1913-14, res. engr. of M. of W. Frederton, N.B. C.P.R.; 1914-17, on active service; 1917-19, supervisor of hydraulic testing of H. E. shell, Imperial Ministry of Munitions, Montreal; 1919-20, transitman, rebuilding bridges between Westmount and Windsor Stn., Montreal, C.P.R.; 1920-21, asst. engr., G.T.R. Valuation, Montreal; At present, estimator for Graham and Windsor, Gen. Contractors, Montreal.

References: J. M. R. Fairbairn, P. B. Motley, A. C. Mackenzie, J. H. Barber, W. Walker, G. R. Kendall, P. E. deLaCour, A. A. Putman, L. Gibson.

SALAMIS—BASIL C., of 158 Hutchison Street, Montreal, Que. Born at Leka, Island of Samos, Greece, April 29th, 1892; Educ., B.Sc., McGill Univ. 1921; 1912, student's elect'l course, Can. Westinghouse, and mach. shop experience with Western Electric Co., Chicago, Ill.; At present asst. on designing theatre lighting, with Jas. Atsalinos, Gen. Contractor, Montra.l.

References: C. M. McKergow, L. A. Herdt, H. M. MacKay, E. Brown, F S. Keith.

UNDERHILL—JOHN LEROY, of Box 132, Sydney Mines, N.S. Born at Blackville, N.B., Feb. 7th, 1896; Educ., private study. I.C.S.; 1913-14, asst. on various land surveys; 1914-15, asst. to arch't., estimating etc.; 1915-18, with Can. Govt. Rlys. as follows:—1915-16, rodman, mtce, of way and constrn, work, 1917-18, instr'man. mtce. of way and constrn. work; 1918-19, asst. office engr. and instr'man. Dominion Steel Corpn., Sydney, N.S.;1920 (Jan.-July), asst. engr. in charge of field layout on constrn. rail and struct'l steel mill, Algoma Steel Corpn., Sault Ste Marie; August 1920 to date with Nova Scotia Steel and Coal Company, Ltd., Sydney Mines, 1920 (Aug.- and-Sept.) dftsman., Oct. 1920 to Aug. 1921, engr in charge of field constrn. of steel bankhead at Jubilee "B" colliery, and Sept. 1921 to date, dftsman.

References: A. W. Sinnamon, B. E. Barnhill, A. D. Jost, R. J. Fisher, H. Longley

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A

ACCIDENT PREVENTION

Foundries. Co-operative Methods for Preventing Foundry Accidents, R. A. Salisbury. Iron Age, vol. 106, no. 20. Nov. 11, 1920, pp. 1268-1269. Committee system of organization including employees is suggested. Paper read before Nat. Safety Council.

Organization for. Employees Rewarded for Self-Protection. Iron Age, vol. 106, no. 19, Nov. 4, 1920, pp. 1189-1191, 4 figs. Organization for accident prevention at plant of Joseph T. Ryerson & Son. One of features is offering prizes to employees with safety records.

ACCIDENTS

Building Construction. Keeping Track of Accidents, F. A. Davidson. Bul. Associated Gen. Contractors, vol. 11, no. 10, Oct. 1920, pp. 14-16, 2 figs. Systematic method for checking safety. Report adopted by Construction Section of National Safety Council.

Foundries. Dangers in Casting. Metal Industry (Lond.), vol. 17, no. 17, Oct. 22, 1920, pp. 323-325. Extracts from annual report of British Chief Inspector of Factories for 1919.

Railway Shops. Shop Accidents, J. A. McNally. Ry. Rev., vol. 67, no. 19, Nov. 6, 1920, pp. 715-716. Costs of accidents in railway shops. From records of Wabash Railroad.

Recording of. Standard Method of Recording Construction Accidents. Eng. News-Rec., vol. 85, no. 18, Oct 28, 1920, pp. 845-847, 3 figs. Argument and instructions for compiling accident statistics formulated by Construction Section of National Safety Council.

ADSORPTION

Colloidal. Colloidal Adsorption, Arthur Mutscheller. Jl. Am. Chem. Soc., vol. 42, no. 11, Nov. 1920, pp. 2142-2160, 4 figs. Experimental study of migration velocity of anions as influenced by presence of reversible colloids, concentration of anions and cations as influenced by presence of reversible colloids, etc.

AERIAL PHOTOGRAPHY

Uses in War and Peace. Aircraft Photography in War and Peace, H. Hamshaw Thomas. Jl. Royal Soc. Arts, vol. 68, nos. 3543, 3544, Oct. 15 and 22, 1920, pp. 749-753 and 763-766. Oct. 15: Taking and production of aeroplane photographs. Cantor lectures; Oct. 22: Uses of aerial photography for securing military information. Graphic record of results of operations.

AEROPLANE ENGINES

Fuels for. *See Gasoline, Alcogas Fuel vs.*

Ignition. *See Ignition.*

Superchargers. Experiments with and Practical Use of Superchargers in Germany, Eric Hildesheim. Automotive Industries, vol. 43, no. 17, Oct. 21, 1920, pp. 810-816, 13 figs. Translated from Zeitschrift des Vereines Deutscher Ingenieure, Motorwagen and Flugsport.

British Air Ministry Competition. The Small Airplanes of the British Competition. Aviation, vol. 9, no. 6, Oct. 15, 1920, pp. 193-196. First report on British Air Ministry competition for commercial aircraft by Edward P. Warner, acting technical assistant in Europe of National Advisory Committee for Aeronautics

Control Surfaces. The Design of Aeroplane Control Surfaces with Special References to Wing Ailerons, H. B Irving. Eng., vol. 110, nos. 2858-2860, Oct. 8, 15, and 22, 1920, pp. 461-463, 493-494, and 527-528, 19 figs. Oct. 8: Aerodynamic properties of control surfaces. Factors which govern controlability of aeroplanes; Oct. 15: Comparison of efficiencies of control of ailerons on wings with differently-shaped tips; and Oct. 22: Graphs showing rolling moment and hinge moment for ailerons of various chords.

Chassis, Retractable. Retractable Chassis as an Aid to Aeroplane Speed and Efficiency, Jas. V Martin. Aerial Age, vol. 12, no 10, Nov 15, 1920, p 274, 2 figs. Importance of retracting aeroplane chassis to increase speed Tests are quoted in which speed was increased 30 miles an hour when chassis was retracted and extended

Cost of Operating. The Operation of Civil Aircraft in Relation to the Constructor, H. White-Smith Flight, vol. 12, no. 42. Oct. 14, 1920, pp. 1079-1088. Detailed study of cost of operating commercial service.

Design. Analytical Process for Calculating the Polar Equation of an Aeroplane (Procédés analytiques pour le calcul des polaires d'avions), Maurice Le Sueur. L'Aérophile, vol. 28, nos. 15-16, Aug. 1-15, 1920, pp 226-229 Analytical method claimed to be equally as precise as graphic method, and more rapid than the latter

Flight Conditions Governing. The Aerotechnical Institute of St. Cyr. Sci. Am. Monthly vol. 2, no. 3, Nov. 1920, pp. 260-263, 110 figs. Apparatus for testing mechanical conditions governing flight of airplanes.

Landing Stations. Landing Fields are a Major Problem Development of Air Traffic. Automotive Industries, vol. 43, no. 19, Nov. 4, 1920, pp. 928-929. Present situation and suggested methods for improvement.

Single vs. Twin Engined. A Comparison of the Flying Qualities of Single and Twin-Engined Aeroplanes, R. M Hill. Flight, vol. 12, no. 44, Oct 28, 1920, pp. 1134-1136, and also Aeronautics, vol. 19, no. 367, Oct. 28 1920, pp. 307-309. Comparison from pilot's point of view. Paper read before Roy. Aeronautical Soc.

Stress Analysis. Airplane Stress Analysis, A. F. Zahm and L. H. Crook. Nat. Advisory Committee for Aeronautics, report no. 82, 1920, 70 pp., 42 figs. Theory of aeroplane stress analysis taking into consideration forces within engine and propeller.

Wings. The Handley Page Wing. Flight, vol. 12, no. 44, Oct. 28, 1920, pp. 1123-1125, 4 figs. Account of first public demonstration of patented high-lift wing.

AIRSHIPS

Commercial. The Commercial Airship—Its Operation and Construction, Trevor Dawson. Eng., vol. 110, no. 2860, Oct. 22, 1920, pp. 558-560. Airplane versus airship. Airship is found more advantageous for commercial service, and its traffic possibilities are pointed out. (Abstract). Paper read at Air Conference London, Oct. 14, 1920.

Rigid. The Aerial Cruiser, Sci. Am., vol. 123, no. 16, Oct. 16, 1920, pp. 400, 409 and 412, 3 figs. Particulars: Gross displacement, 38.25 tons; disposable lift, 17.80 tons; total b.hp. at full power, 1000; range in miles, full power, 3900; maximum height attainable with crew and stores, 17,000 ft.

See also Balloons.

ALCOHOL

Ethyl, from Wood Waste. The Manufacture of Ethyl Alcohol from Wood Waste, G. H. Tomlinson. Dominion of Canada, bul. no. 7, 1919, 9 pp. Chemical processes.

Waste Sulphite Liquid as Source. Canadian Waste Sulphite Liquor as a Source of Alcohol, Vernon K. Krieble. Dominion of Canada, report no. 5, 1919, 14 pp., 2 figs. A dozen representative Canadian sulphite liquors were analyzed. Results showed that best liquors contained as high a percentage of sugar as those produced in Europe. Yield from Canadian sulphite liquors is estimated at least one per cent of alcohol by volume.

See also Automobile Fuels, Alcohol.

ALLOY STEELS

Non-Expanding. Important Swiss Discovery Affecting Watchmaking. Commerce Reports, no. 260, Nov. 4, 1920, p. 569. C. E. Guillaume, director of International Bureau of Weights and Measures announces discovery of alloy steel which will experience no changes with variation in temperature. Alloy is a nickel steel with 12 per cent chrome.

Uranium and Chrome-Vanadium. Uranium as a Structural Steel Alloy, Hugh S. Foote Ry Mech. Engr., vol. 94, no. 11, Nov. 1920, pp. 695-696. Characteristics of uranium steel. Static and dynamic tests of uranium and chrome-vanadium steels.

ALLOYS

Molybdenum, Cobalt and Chromium. The Analysis of Molybdenum, Cobalt, and Chromium Alloys, J. R. Camp and J. W. Marden. Jl. Indus. and Eng. Chem., vol. 12, no. 10, Oct. 1920, p. 998. Results of series of analyses made on samples of metal obtained by aluminothermic reduction method.

ALTERNATORS

See Electric Generators, A. C. Slow-Speed.

ALUMINUM

Automobile Parts. Machining Aluminum Automobile Parts. Machy. (Lond.), vol. 17 no. 422, Oct. 28, 1920, pp. 97-101, 9 figs. Account of recent practice.

Nickel Plating of. Nickel-Plating Aluminum and Alloys. Sci. Am Monthly, vol. 2, no. 3, Nov. 1920, p. 267. It was found in tests that sheet metal treated with fine ground sand and under pressure of 1500 grams per sq. cm. could be kept in good state if wrapped in sheet of filter paper for 30 days before being nickel-plated. Sheets of metal treated with sand blast under these conditions were nickel-plated up to 0.04 mm. Translated from Revue de Métallurgie.

ALUMINUM ALLOYS

Analysis of. A Rapid and Systematic Method for the Analysis of Light Aluminium Casting Alloys, Russell M. Berry. Jl. Indus. and Eng. Chem., vol. 12, no. 10, Oct. 1920, pp. 998-1000. Method developed at U. S. Navy Yard, Philadelphia, Pa.

APPRENTICES, TRAINING OF

Engineering Apprentices. The practical Training of Engineering Apprentices [Die praktische Ausbildung der Ingenieurlehrlinge (Praktikanten)]. Betrieb, vol. 2. no. 15, Aug. 1920, pp. 413-415. Advice to machine industrials. Proposal of the German Committee for Technical Instruction.

Machinists. A Worth-While Training Department, L. C. Morrow. Am. Mach., vol 53. no. 20, Nov. 11, 1920, pp. 893-896, 3 figs. Methods at shop of American Tool Works, Co., Cincinnati.

Training Apprentices for Permanent Jobs, Norman G. Shidle. Automotive Industries, vol. 43, no. 19, Nov. 4, 1920. pp. 923-925, and p. 929, 3 figs. Training course for machinists operated for 40 years at works of Warner & Swasey Co., Cleveland.

Methods. Modernizing the Apprenticeship, Erik Oberg. Machy. (N.Y.) vol 27. no. 3, Nov. 1920, pp. 220-224, 7 figs. Review of methods used by Taft-Pierce Mfg. Co., Woonsocket, R.I., in training apprentices along broad, comprehensive lines. intended to ultimately fit them for important position in mechanical industries.

Programs of Apprenticeship and Special Training in Representative Corporations—IV, J. V. L. Morris. Am. Mach.. vol. 53, no. 19 Nov. 4, 1920, pp. 847-852, 8 figs. Methods of Westinghouse Electric Mfg Co., East Pittsburgh, Pa.

Secondary Technical Education, F. H. Sexton. Jl. Eng. Inst. Canada, vol. 3, no. 11, Nov. 1920, pp. 505-509. Discussion of present and proposed methods of training in industry: vocational training, what it has accomplished in Great Britain and America, and part to be played by engineers.

ARCHES

Brick. Arch Brick Work, A. D. Williams. Iron Age, vol 106, no. 20, Nov. 11, 1920, pp. 1264-1265, 1 fig. Formulæ and tables for fantail or taper arches.

ATMOSPHERE

Electrical Phenomena at High Levels. Electrical Phenomena Occurring at Levels in the Atmosphere, C. Chapman. Jl. Instn. Elec. Engrs. (Supp.), vol. 57, part 2, Oct. 1920, pp. 209-216 and (discussion) pp. 217-232. 4 figs. General outline of subjects based on published reports of observations.

AUTOGENOUS WELDING

Purity of Oxygen. Investigation of the Purity of Oxygen of Autogenous Welding (Untersuchungder Reinheit des Sauerstoffs für Autogenschweisserein). Autogene Metallbearbeitung, vol. 13, nos. 14 and 15, July 15 and Aug. 1, 1920, pp. 157-162 and 175-177, 5 figs. Includes two tables giving costs of autogenous welding with pure oxygen and the influence of a lesser degree of purity on welding costs and on danger of explosion. Discusses the Dräger device for protection against burning out.

AUTOMOBILE ENGINES

Cam-Grinding. A New Attachment for Grinding of Cams. Automotive Industries, vol. 43, no. 19, Nov. 4, 1920, pp. 921-922. 3 figs. Landis cam-grinding attachment.

Ignition. *See Ignition.*

Starters. Electric Starting and Lighting of Automobiles (Eclairage et démarrage électriques des automobiles). Génie Civil, vol. 77, no. 14, Oct. 2, 1920, pp. 273-276. 5 figs. Bicompound dynamo built by Bleriot Works, Paris

Impulse Starters Automobile Engr., vol. 10, no. 143, Oct. 1920, pp. 417-418, 6 figs. Notes on new M-L device.

Alcohol. Possible New Sources of Power Alcohol, C. Simmonds. Nature (London), vol. 106, no. 2660, Oct. 21, 1920, pp. 244-245. Report by Fuel Research Board, department of Scientific and Industrial Research.

Gasoline Substitute. Alternative Fuels. Eng., vol. 110. no. 2860, Oct. 22, 1920, pp 543-544. Editorial comment on conflict in views presented at Fuel Section meetings of Imperial Motor Transport Conference held in London during Commercial Vehicle Exhibition.

Mixtures. Fuel Mixtures on London 'Buses, G. J. Shave. Motor Traction, vol. 31, no. 817, Oct. 25, 1920, pp. 493-494, 2 figs. Experiments carried out by London General Omnibus Co. Alcohol benzole, alcohol-ether, and alcohol-ether-benzol mixtures have been investigated.

See also Gasoline.

AUTOMOBILES

Air Brakes. Air Brakes for the Automobile, C. W. Geiger. Sci. Am., vol. 123, no. 19, Nov. 6, 1920, pp. 467 and 480, 2 figs. System tested at Safety First Exposition held in conjunction with Nat. Traffic Officers' Convention at San Francisco. Air pressure is obtained from one cylinder of engine and is automatically maintained by means of accumulator valve with only one moving part.

Quantity Production. Machine Tool Practice as Applied to Motor-Car Production. Machy. (Lond.), vol. 17, no. 421, Oct. 21, 1920, pp. 68-75, 13 figs. Review of production methods employed by Vulcan Motor & Eng. Co. (1906), Ltd., Southport, England.

AVIATION

Aerial Mail Service. Aerial Postal Service (La voie postale aérienne), Georges Brunel. L'Aérophile, vol. 28, nos. 15-16, Aug. 1-15, 1920, pp. 240-245. Survey of developments throughout the world.

Aerial Transportation. Time Table and Tariff of Air Companies Operating at Paris. Aeronautics, vol. 19, no. 364, Oct. 7, 1920, p. 262. There are four companies operating between Paris-London; one between Paris and Geneva; one between Toulouse and Bordeaux; two between Paris and Brussels; one between Toulouse and Montpellier; and one between Toulouse and Agen.

British Air Ministry. The Air Conference. Eng., vol. 110, nos. 2859 and 2860, Oct. 15 and 22, 1920, pp. 512-515 and 528-532. Proceedings of Air Conference called by Air Ministry for purpose of discussing technical and economic problems connected with aviation. (Abstract.)

Civil. Civil Aviation and Air Services, S. H. Sykes. Eng., vol. 110, no. 2859, Oct. 15, 1920, pp. 524-526. Growth and present position of air mail passenger and good services in British Empire, France and United States. (Abstract.) Paper read at Air Conference at London, Oct. 12, 1920.

Contests. Two Great Aviation Contests in 1920 (Deux grandes épreuves d'aéronautique de 1920). Génie Civil, vol. 77, no. 17, Oct. 23, 1920, pp. 325-328, 8 figs. Contest for the Gordon-Bennett Cup held on Sept. 28, and the Bue Meeting, Oct. 8-10.

See also Flight.

AVIATORS

Physiological Phenomena at High Altitudes. Aviators at High Altitudes (Les aviateurs aux hautes altitudes), Jacques Boyer. Nature (Paris), no. 2422, Sept. 4, 1920, pp. 145-148, 3 figs. Physiological experiments at French Aerotechnical Inst.

B

BALLONS

Dilatable. Dilatable Balloons, James F. Boyle. Aviation, vol. 9, no. 6, Oct. 15, 1920, pp. 184-186, 6 figs. Balloons recently built and tested by War Department.

Hydrogen Helium Mixtures for. Inflammability of Jets of Hydrogen and Inert Gas. P. G. Ledig. Jl. Indus. & Eng. Chem., vol. 12, no. 11, Nov. 1920, pp. 1098-1100, 4 figs. Experimental work to determine maximum amount of hydrogen which can be used with helium in balloons without losing advantage of noninflammability. Up to 18 to 20 per cent of helium was found to be safe proportion.

BATTERIES

Clark Standard Cell. The Two Common Failures of the Clark Standard Cell, E. C. McKelvy and M. P. Shoemaker. Sci. Papers, Bur. of Standards, no. 390, July 21, 1920, pp. 409-420, 8 figs. Cracking at amalgam terminal is remedied by employing platinum wire previously subjected for a short time to the action of hot ten per cent zinc amalgam, using lead sealing-in glass. Interruption of circuit by gradual formation of gas in amalgam limb is reduced by using smallest excess of crystals required to insure saturation at highest temperature at which cell is likely to be used.

Dry Cells, Testing. Automatic Apparatus for Intermittent Testing, G. W. Vinal and L. M Ritchie. Technologic Papers, Bur. of Standards, no. 171, July 22, 1920, 7 pp., 6 figs. Apparatus devised at Bureau of Standards for making tests of dry cells and storage batteries. It is applicable to any form of intermittent test requiring closing of electrical circuits at regular time intervals.

BEAMS

Bending Moments. A Self-Checking String Polygon, Theodore Bleckmann. Eng. News-Rec., vol. 85, no. 19, Nov. 4, 1920, pp. 880-881, 3 figs. Graphical method in which paralleling is replaced by measurement.

See also Girders.

BEARINGS, BALL

Roller and. What is the Difference Between Roller and Ball Bearings, A. Danielson. Am. Mach., vol. 53, no. 19, Nov. 4, 1920, pp. 857-858, 5 figs. Suggestions for definite classification of these two types.

BENZOL

Recovery from Coal Gas. The Recovery of Vapours from Gases Particularly of Benzene and Toluene from Coal Gas, Harold S. Davis and Mary Davidson Davis. Dominion of Canada, report no. 2, 1918, 15 pp., 2 figs. Results of research carried out in University of Manitoba, and of tests conducted at Light Oil Recovery Plant of Toronto Chemical Co.

BLAST-FURNACE GAS

Cleaning. Cleaning Blast-Furnace Gas. A. Hutchinson and E. Bury. Eng., vol. 110, no. 2857, Oct. 1, 1920, pp. 453-456, 4 figs. Rough-cleaning of blast-furnace gas at Skinningrove by the Lodge Electrostatic Process. Paper read before Iron & Steel Inst.

Power Production from. The Production of Power from Blast-Furnace Gas, S. H. Fowles. Jl. Instn. Elec. Engrs., vol. 58, no. 292, June 1920, pp. 431-436 and (discussion) pp. 437-463, 3 figs. Survey of old and new methods of utilization of waste heat.

BLAST FURNACES

Heat Supplied to. The Effect of Heat Supplied to the Blast Furnace, W. W. Hollings. Eng., vol 110, no 2857, Oct 1, 1920, pp. 459-460. Variations in heat supplied to blast-furnace, and their effect on fuel consumption. Paper read before Iron & Steel Inst.

Large Hearths. Development of Large Furnace Hearth, Walter Mathesius. Blast Furnace & Steel Plant, vol 8, no 11, Nov 1920, pp 588-592, 6 figs.; Chem & Metallurgical Eng., vol 23 no 18, Nov 3, 1920, pp 867-872, 6 figs.; Iron Trade Rev vol 67, no. 18, Oct 28, 1920, pp 1211-1213, 6 figs; and Iron Age, vol 106 no 18, Oct 28, 1920, pp 1103-1104, 1 fig. Wide hearth permits steeper bosh and flatter stack lines with many resulting economies, especially for smelting Mesaba ores. Operating data, construction details and theoretical considerations point to its definite superiority. Paper read before Am. Iron and Steel Inst.

Remodeling. Rebuilt Furnace Conserves Labor. Iron Trade Rev., vol. 67, no. 17, Oct. 21, 1920, pp 1123-1126, 5 figs. How capacity of furnace of Belfont Iron Works Co., Ironton, O., was increased two-thirds.

Stack Design. Designs Stack for Foundry Iron. Iron Trade Rev., vol 67, no. 16, Oct 14, 1920, pp 1068-1070, 4 figs. Bosh is cooled by series of louvers which keep film of water flowing over entire jacket. Big bell suspended from yoke on account of filling system. Charge weighted on floor-type scale.

BOILER FEEDWATER

Automatic Regulator for. An Automatic Feed Regulator. Engr., vol. 130, no. 3380, Oct. 8, 1920, p 352, 3 figs. Manufactured by A. G. Mumford, Ltd., Colchester, England. Regulator acts directly on feed check valve and relies for its effect on control of leakage past piston connected with valve.

Testing. Simple Methods of Determining Dissolved Gas Content in Boiler-Feed Water, J. R. McDermet and Daniel Wertheimer. Power, vol 52, no. 18, Nov. 2, 1920, pp. 686-688, 3 figs. Methods which do not require special laboratory glassware or skilled operator.

BOILER FIRING

Lean Gas as Fuel. Lean Gas as Boiler Fuel. Iron Age, vol 106, no. 20, Nov. 11, 1920, pp. 1261-1262, 1 fig. Low grade coals used in coke ovens and coke utilized in gas producers. Experiments carried on by Société desères de Montrambert et de la Béraudière at St Étienne, France.

BOILERS

Electrically Heated. Recent Developments of Electrically-Heated "Revel" Boilers in Switzerland, F. G. Constam-Gull. Eng., vol. 110, no 2861, Oct. 29 1920, pp. 563-565, 4 figs. Revel boiler has overall diameter of 24 in. and total height of 8 ft. It produces 1200 lb of steam per hour at gage pressure of 225 lb per sq in. when supply current is at 500 volts. Efficiency corresponds to evaporation of 2.8 lb. of standard steam per kilowatt-hour. Evaporation and heating of steam is accomplished within immediate vicinity of water level.

Gas-Fired. Use of Gas Fired Boilers, C. M Grow. Gas Rec., vol. 18, no. 7, Oct. 13, 1920 pp. 39-42. Appliances for domestic and commercial heating on Pacific coast. Paper read before Pacific Coast Gas Assn.

Industrial Code. Rules as Amended Relating to the Construction, Installation, Inspection and Maintenance of Steam Boilers. Bul. no 14, Industrial Code, State of New York, Dept. of Labor, State Industrial Commission, 148 pp., 33 figs. Rules amended and readopted to become effective July 1, 1920.

Oil-Fired. Soot Deposits in Oil-Fired Boiler. Robert June. Power Plant Eng., vol 24 no. 22, Nov. 15, 1920, pp. 1061-1063, 2 figs. Description of tests indicating advisability of equipping oil-fired boilers with soot blowers.

Patches. Design of Patches. Universal Engr., vol 32, no. 4, Oct. 1920, pp. 38-40, 1 fig. Factor diagram for diagonal patch seams on bottoms of horizontal return tubular boilers.

Through Stays. A Limiting Formula for Long Through Stays, John S. Watts. Boiler Maker, vol. 20, no. 10, Oct 1920, pp 297-298, 1 fig. Discussion of method of determining proper sizes of through stays in boilers. Chart developed to simplify calculations.

Tubes. The Constitution and Properties of Boiler Tubes, Albert E. White. Mech. Eng., vol. 42, no. 11, Nov. 1920, pp. 603-606, and p. 618.

BORING MACHINES

Heavy-Duty. Heavy-Duty Boring Machine. Machy. (N.Y.), vol. 27, no. 3, Nov. 1920, pp. 259-260, 3 figs. Machining headstock and tailstock castings for ninety-inch driving wheel lathes.

BRACKETS

Design. Stresses in Brackets and Their Bolts, Victor M. Summa. Machy. (N.Y.), vol. 27, no. 3, Nov 1920, pp. 239-241, 4 figs. Formula for computing stresses, bending moment diagrams, etc.

BRASS

Melting with Fuel Oil. Melting Brass with Fuel Oil—1, S. D. Rickard. Metal Industry (N.Y.), vol. 18, no. 10, Oct. 1920, pp. 460-463, 2 figs. Analysis of costs and comparison with other fuels, showing that fuel oil is most economical.

BRIDGES, HIGHWAY

Reconstruction. Strengthening and Reconstructing Highway Bridges for Heavy Motor Truck Traffic. Eng. & Contracting, vol. 54, no. 17, Oct. 27, 1920, pp. 412-414. Progress report of Committee of American Road Builders' Association.

BRIDGES, MOVABLE

Electric Operation. Electric Operation of Movable Bridges (La manœuvre électromécanique des ponts mobiles), Joseph Chanteux. Annales des Travaux publics de Belgique, vol 21, no 4, Aug 1920, pp 515-594, 45 figs on 15 supp. plates. General theory. Design formulæ. Three types are considered: lift bridges, turning bridges, and bascule bridges. (To be continued.)

BRIDGES, RAILWAY

Reconstruction. Heavy Spans to be Rolled and Jacked in Difficult Bridge Reconstruction. Eng News-Rec. vol 85, no 19, Nov 4, 1920, pp 904-907, 3 figs. New double-track structure of increased load capacity provides wider channel openings and greater clearance height. Erection under traffic. Will shift track to higher elevation in one day.

Specifications. New Steel Railway Bridge Specification. Can. Engr., vol 39, no 17, Oct 21, 1920, pp 443-445. Canadian Engineering Standards Association issues specification for bridges not exceeding 500-ft span based on draft prepared by Engineering Institute. Cooper's loadings and American Railway Engineering Association's impact formula adopted. Secondary stress computation optional. Parabolic column formula. Movable bridges.

BUILDING CONSTRUCTION

See Walls.

C

CARS

Buffers. A Self-Contained Railway Buffer with Non-Breakable Shank. Ry. Gaz., vol. 33, no. 17, Oct 22, 1920, p. 550, 2 figs. Railway buffer fitted with George Spencer Moulton & Co.'s patent rubber spring.

Tipping. Railway Loading and Off-Loading Arrangements, H. Aumund. Eng. Progress, vol. 1, no. 10, Oct. 1920, pp 309-313, 13 figs. Problems of rail transport. Railway tipping cars and their various designs. Arrangement, construction, application, and capacity of new portable tipping device. Comparison with automatic tipping arrangements.

Weighing Machines. A New Railway Wagon Weighing Machine, T. J. Primrose. Ry. Engr., vol. 41, no 490, Nov. 1920, pp. 454-455, 5 figs. Apparatus for measuring load on locomotive and car wheels with object of finding pressure with which wheels bear upon rails.

CEMENT GUN

Fireproofing with. Tests Show that Buildings May Be Rendered Fireproof with Gunite, B. C. Collier. Coal Age, vol 18, no 19, Nov. 4, 1920, pp. 939-942, 3 figs. Tests made by Anaconda Copper Mining Co. and at Underwriters Laboratory in Chicago.

CENTRAL STATIONS

Cuba. Central-Station Operation in Tropical America, D. E. Cowling. Power, vol. 52, no. 16, Oct. 19, 1920, pp. 606-609, 5 figs. Central station in Havana, Cuba. Plant supplies current for operation of electric railway and electric light and power service for city of Havana.

Middle West. Power Service for a Middle West Section, Lyle A. Whitsit. Elec. World, vol. 76, no. 20, Nov. 13, 1920, pp 969-971, 2 figs. Survey in Western Pennsylvania and Eastern Ohio by power section of War Industries Board indicates aggregate power peak demand during 1918 of 568,000 kw. and total central-station, output in this district of 2,440,000,000 kw.-hr. Estimated increased peak of 1,000,000 kw. by. 1927.

CHEMICAL INDUSTRY

Sweden. Chemical Industry and Trade of Sweden, O. P. Hopkins. Jl Indus. & Eng. Chem., vol. 12, no. 11, Nov. 1920, pp. 1045-1054. Statistics showing strengthening of industries since 1914.

CHROME-NICKEL STEEL

See Alloy Steels, Non-Expanding.

COAL

Conservation. George Otis Smith on Thrift in Coal. Iron Age, vol. 106, no. 18, Oct. 28 1920, pp. 1122-1124, 3 figs. Suggestions for economical use of coal in steel industry and by railroads. Paper read before Am. Iron & Steel Inst.

Thrift in Coal, George Otis Smith. Power, vol. 52, no. 18, Nov. 2, 1920, pp. 716-718, 3 figs. Suggestions in regard to coal combustion. Paper read before Am. Iron and Steel Inst.

Mixtures. Graphic Method of Determining Proportions of Coal Mixtures, Edward J. Clarke. Power Plant Eng., vol. 24, no. 22, Nov. 15, 1920, p. 1066, 1 fig. Chart for determining proportions of coal mixtures.

Oil vs. Coal Versus Oil Performance Chart, L. C. Lichty. Indus. Management, vol. 60, no. 5, Nov. 1920, pp. 351-352, 5 figs. Calculations are based on cost per ton of coal delivered at plant, its heating value and efficiency of boiler plant when burning coal, in comparison, with results determined by making use of density of oil fuel, heating value per barrel, cost per barrel delivered and efficiency when burning fuel.

Supply. The Problems of Coal Supply, Eugene McAuliffe. Elec. Ry. Jl., vol. 56, no. 16, Oct. 16, 1920, pp. 754-759, 5 figs. It is said that storage at point of consumption will improve "load factor" of fuel production and distribution. It is believed that national legislation providing for seasonal variation in coal-haulage rates would encourage uniformity of demand for coal and reduce mining costs. (Abstract.) Paper read before Am. Elec. Ry. Assn.

COAL BREAKERS

Dry Treatment. Preparing Anthracite for Market Without the Use of Water, Dever C. Ashmead. Coal Age, vol. 18, no. 19, Nov. 4, 1920, pp. 935-938, 8 figs. It is claimed that mechanical equipment and dust suckers render dry treatment almost as free from dust as wet preparation.

COAL GAS

Detarring. The Detarring of Gas by Electrical Precipitation, J. G. Davidson. Dominion of Canada, report no. 3, 1918, 45 pp., 4 figs. Report of experimental work. Successful tests of process of electrical precipitation for detarring of gas on commercial scale were made in wood, coal and petroleum distillation plants.

COAL MINES

Bituminous, Gas Explosion Prevention. Rules for Prevention of Gas Explosions, R. A. Walter. Coal Age, no. 18, no. 19, Nov. 4, 1920, pp. 945-947. Rules based on writer's experience gained in bituminous coal mines as mine owner and manager for many years. Paper read before Ninth Annual Safety Congress.

COAL MINING

Difficulties Overcome. By New Operating Methods Estimated Life of Seneca Colliery has been Tripled, Dever C. Ashmead. Coal Age, vol. 18, no. 17, Oct. 21, 1920, pp. 839-845, 8 figs. Many difficulties, such as subterranean outcrops in glacial drift, mining under river beds, large inflow of water and one bed squeezed over practically entire area, have been encountered and surmounted in operating this mine.

COAL STORAGE

Fire Hazard. A Few of the Less Emphasized Causes Why Fine Sizes Ignite Soft-Coal Piles, O. P. Hood. Coal Age, vol. 18, no. 17, Oct. 21, 1920, pp. 845-848, 8 figs. One ton of coal in solid exposes 47 sq. ft. of surface to air. Crushed so as to pass sixteen-mesh sieve it exposes about one acre of surface. Extent and freshness of surface exposed and rapidity of ventilation are chief factors governing spontaneous heating. (Abstract.) Address delivered before Pennsylvania Elec. Assn.

Fire Prevention. The Storage of Coal, W. D. Langtry. Power, vol. 52, no. 18, Nov. 2, 1920, pp. 693-694, 6 figs. Relation method of piling coal bears to number of fires. Data are given which show that hand shoveling reduces fire hazard.

COKE

Advantages as Fuel. Coke in Relation to Cheap Power, Transport and Smoke Abatement, E. W. L. Nicol. A Thousand and One Uses for Gas (Supp.), vol. 8, no. 81a, pp. 4-20, 20 figs. Advantages of coke as fuel. Performance record of coke-fired boilers.

Hydrogen as Desulphurizing Agent. The Desulfurizing Action of Hydrogen on Coke, Alfred R. Powell. Jl. Indus. & Eng. Chem., vol. 12, no. 11, Nov. 1920, pp. 1077-1081, 1 fig. Curves showing elimination of sulphur as hydrogen sulphide from coal when coked under different conditions.

COKE MANUFACTURE

Reactions in. A Study of the Reactions of Coal Sulfur in the Coking Process, Alfred R. Powell. Jl. Indus. & Eng. Chem., vol. 12, no. 11, Nov. 1920, pp. 1069-1077, 3 figs. Experimental studies at Bureau of Mines.

COKE OVENS

Rotating. Low-Temperature Distillation of Coal in Rotating Coke Oven, Ing. E. Roser. Power, vol. 52, no. 17, Oct. 26, 1920, pp. 678-679, 1 fig. Low-temperature tar is reported to yield 90 per cent bitumens in coal as against 50 per cent under present methods. Translated from Stahl und Eisen.

COLLOIDS

Colloid Mill. Colloidal Chemistry and a "Colloid Mill." Eng., vol. 110, no. 2857, Oct. 1, 1920, pp. 429-430. New Type of fine grinding disintegrator or "colloid" mill claimed to be ideal apparatus for extremely fine grinding required for homogenizing and dissolving substances and for obtaining emulsions and colloidal preparations. Translated from Chemiker-Zeitung.

COMPASSES

Gyroscopic. Principles of the Gyro-Compass, George B. Crouse. Mech. Eng., vol. 42, no. 11, Nov. 1920, pp. 619-623, 16 figs. Problems of design, specially compensation of disturbing factors, methods of suspension and methods of damping.

CONCRETE

Pavement Slabs. Study of Temperature Stresses in Rigid Pavement Slabs, C. H. Scholer. Eng. News-Rec., vol. 85, no. 20, Nov. 11, 1920, pp. 943-944, 3 figs. Research at Engineering Experiment Station of Kansas State Agricultural College.

CONCRETE CONSTRUCTION

Marine Structures. The Durability of Maritime Structures. Nature (London), vol. 106, no. 2660, Oct. 21, 1920, pp. 235-236. Report of Committee of Instn. of Civil Engrs., appointed to investigate deterioration of structures of timber, metal and concrete exposed to action of sea water.

CONCRETE CONSTRUCTION, REINFORCED

Coal Mines. Ferro-Concrete Pit-Head Frame at Bently Colliery, Doncaster. Eng., vol. 110, no. 2859, Oct. 15, 1920, pp. 498-501, 71 figs., partly on supp. plate. Main building is about 132 ft. long by 32 ft. wide, with height, from foundations to roof of 64 ft.

CONCRETE, REINFORCED

Flat Slab. Diagram for Flat Slab Design, O. Wolpert. Eng. & Contracting, vol. 54, no. 17, Oct. 27, 1920, p. 411, 1 fig. Diagram for estimating amount of reinforcing steel and thickness of slab required by New York City 1920 regulations.

CONDENSERS, ELECTRIC

Electrostatic. Electrostatic Condensers, V. E. Goodwin. Jl. Am. Inst. Elec. Engrs., vol. 39, no. 11, Nov. 1920, pp. 976-983, 13 figs. Fundamental characteristics of condensers and their relation to electric circuits containing inductance and resistance. Effects of switching condensers on and off such circuits. Applications of condensers.

CONDUITS

Concrete. Casting and Steaming Reinforced Pipe, Public Works, vol. 49, no. 16, Oct. 16, 1920, pp. 358-360, 6 figs. Fabricating and seasoning in contractor's yard ten miles of reinforced concrete pipe 5½ ft. in diameter and 8 in. thick.

CONNECTING RODS

Machining. Machining the Connecting Rods of Two Well Known Motors, Fred H. Colwin. Am. Mach., vol. 53, no. 19, Nov. 4, 1920, pp. 829-834, 20 figs. Method of manufacturing connecting rods for Oakland and Studebaker motors.

Steel. Studies on the Corrosive Action of Chlorine-Treated Water. I—The Effects of Steel on the Equilibrium: $Cl_2+H_2O=HCl+HClO$, and of Products of the Equilibrium of Steel, George L. Clark and R. B. Iseley. Jl. Indus. & Eng. Chem., vol. 12, no. 11, Nov. 1920, pp. 1116-1122. Based on records of corrosion produced by water of various American cities.

Theories of. The Effect of Air and Water on Materials Used in Engineering Work, H. E. Yerbury. Jl. Instn. Elec. Engrs. (Supp.), vol. 57, part 2, Oct. 1920, pp. 118-126 and (discussion) pp. 126-1233. Chemical and electrolytic theories of corrosion. Effects on iron and steel and non-ferrous alloys. Instances of damage to metals, etc., subjected to air and water.

COST ACCOUNTING

Machine Shops. Machine Rate Hour in Distributing Expense, Christopher Haigh. Iron Age, vol. 106, no. 19, Nov. 4, 1920, pp. 1207-1208. General advantages of method. (Abstract.) Paper read before Am. Gear Manufacturers' Assn.

Predetermining Needs. When, What and How Much to Buy, Charles W. Dean. Indus. Management, vol. 60, no. 5, Nov. 1920, pp. 362-364, 5 figs. Predetermining raw material needs as function of cost accounting.

CRANES

Floating. Two Hundred-Ton Floating Crane for Liverpool. Engr., vol. 130, no. 3381, Oct. 15, 1920, pp. 375 and 378, 3 figs. Crane lifts weight of 200 tons and hoists up to height of 170 ft. above water line at distance of 110 ft.

Safety Devices. Crane Safety Devices, Nicholas Prakken Metal Trades, vol. 2, no. 11, Nov. 1920, pp. 453-455, 5 figs. Typical safety devices for cranes used in foundries, machine shops, yards, shipyards and warehouses. Paper read before Nat. Safety Congress.

CRANKSHAFTS

Torsional Vibration. The Critical Speeds of Torsional Vibration, F. M. Lewis. Jl. Soc. Automotive Engrs., vol. 7, no. 5, Nov. 1920; pp. 418-424 and (discussion) pp. 424-431, 14 figs. Mathematical study.

Torsional Vibration and Critical Speeds in Crankshafts, J. F. Fox. Jl. Soc. Automotive Engrs., vol. 7, no. 5, Nov. 1920, pp. 413-417 and p. 435, 14 figs. Vibration chambers constructed to overcome torsional vibration in crankshaft of submarine engine.

CUTTING METALS

Drilling. Supplement to Frederick W. Taylor's "On the Art of Cutting Metals"—XII, Carl G. Barth. Indus. Management, vol. 60, no. 5, Nov. 1920, pp. 365-372, 14 figs. Writer shows how intelligent study of drill shapes, speeds and feeds may be made to contribute to tool endurance and increased production.

See also Oxy-Acetylene Cutting.

CYANAMID PROCESS

Action of CO on. Studies on Calcium Cyanamide, Naoto Kameyama. Jl. College of Eng., Tokyo Imperial University, vol. 10, no. 9, Aug. 25, 1920, pp. 309-347, 7 figs. Action of carbon monoxide upon calcium cyanamide.

Heat of Formation. Heat of Combustion and Heat of Formation of Calcium Cyanamide, Naoto Kameyama. Jl. College of Eng., Tokyo Imperial University, vol. 10, no. 10, Aug. 30, 1920, pp. 239-253. Experimental determination.

Preparation. On the Preparation of Cyanamide of Calcium, Naoto Kameyama. Jl. College of Eng., Tokyo Imperial University, vol. 10, no. 8, July 25, 1920, pp. 173-207. Experimental study of chemical reactions, taking urea and dicyandiamide as amides.

CYLINDERS

Cores. Cylinder Cores Made in Green Sand. Foundry, vol. 48, no. 21, Nov. 1, 1920, pp. 861-866, 12 figs. Special machines for cores and molds together with accurately fitting flasks and arbors are outstanding features of process.

D

DAMS

Concrete, Gravity. Construction Features of Snow Mountain Dam. Elec. Rev. (Chicago), vol. 77, no. 19, Nov. 6, 1920, pp. 725-726, 1 fig. Methods used in building gravity concrete dam for impounding storage water for Eel River Hydroelectric Plant of the Snow Mountain Water & Power Co. in California.

Tilting. Tilting Dams Applied to Water Works Reservoirs, J. F. Springer. Fire & Water Eng. vol. 68, no. 18, Nov. 3, 1920, pp. 915-917, 5 figs. Description of Baltimore elastic dam with sections that tilt as backwater pressure approaches danger point. Sections open automatically at head at which they are set.

DIES

Embossing. Steelstamps. Embossing Dies. Stencils, Ellworth Sheldon. Am. Mach., vol. 53, no. 18, Oct. 28, 1920, pp. 789-794, 2 figs. Description of processes.

DIESEL ENGINES

Cement Mills. Diesel Engines in Cement Mills, Power, vol. 52, no. 17, Oct. 26, 1920, pp. 655-659, 3 figs. Installation at Iola, Kansas, of Lehigh Portland Cement Co. Engines have proven economical.

Compressorless. Diesel Engines Without Compressors (Ueber kompressorlose Dieslmaschinen), Arthur Balog. Der praktische Maschinen-Konstrukteur, vol. 53, no. 31, Aug. 5, 1920, pp. 282-284, 5 figs. It is claimed that Diesel engines can only become perfect when the spraying compressor is eliminated; an auxiliary compressor should suffice for starting; spraying can be effected with or without aid of spraying medium.

Experiments. British Admiralty Experiments with Diesel Engines—II, C. J. Hawkes. Motorship, vol. 5, no. 11, Nov. 1920, pp. 998-1001, 3 figs. Four-stroke vs. 2-stroke opposed-piston types. (Continuation of serial.)

Fuels for. Fuel for Diesel Engines, C. H. Peabody. Marine Eng., vol. 25, no. 11, Nov. 1920, pp. 915-917. Characteristics of various fuels.

Marine. New Double-Acting, Two-Cycle Marine Diesel-Engine, M. Goldberg. Motorship, vol. 5, no. 11, Nov. 1920, pp. 993-994, 4 figs. American engine of two-cycle double-acting type. Scavenging air pump between working cylinders.

The Present Position of the Marine Diesel Engines, James Richardson. Eng., vol. 110, no. 2861, Oct. 29, 1920, pp. 589-592, 2 figs. Comparative economy of Diesel engines and steam engines for shipbuilders. Paper read before Instn. Engrs. & Shipbuilding in Scotland.

DRILLING

Rock, Dust Produced. Investigations Made with the Konimeter to Ascertain the Amount of Dust Produced in Drilling Holes by Means of Dry Jack Hammer Machines, J. E. Barrett. Jl. Chem., Metallurgical & Min. Soc. of South Africa, vol. 21, no. 1, July 1920, pp. 1-8.

Rock, Sticking of Steel. Stuck Steel, D. E. Dunn. Eng. & Min. Jl., vol. 110. no. 19, Nov. 6, 1920, pp. 903-905, 8 figs. Reasons for sticking of drill steel.

See also Cutting Metals, Drilling.

DRILLING MACHINES

High-Speed Radial. The New Asquith High-Speed Radial. Machy. (Lond.), vol. 17, no. 419, Oct. 7, 1920, pp. 28-29, 1 fig. Radial drilling machines produced to meet demands for medium-sized high-speed machine to deal with holes of moderate size in work.

DRY KILNS

Superheated Steam. Drying Lumber with Superheated Steam. Forest Products Laboratory, Technical Notes, Oct. 15, 1920, no. 111, 1 p. Superheated steam process has been found applicable to Douglas fir, firs of all kinds, western hemlock, white cedars, sugar pine, western yellow pine and southern yellow pine. Process is unsuited for some softwoods on account of collapse.

Water Spray. Mannual for Design and Installation of Forest Service Water Spray Dry Kiln, L. V. Teesdale. U. S. Dept. Agriculture, bul. no. 894, Oct. 18, 1920, 47 pp., 18 figs.

E

ELECTRIC CIRCUITS, A. C.

Current Distribution. A Device for the Rapid Determination of the Current Distribution on the Line Side of a Three-Phase Interconnected Star Static Balancer Operating on a Four-Wire System. S. Austen Stigant. Jl. Instn. Elec. Engrs. (Supp.), vol. 57, part 2, Oct. 1920, pp. 201-208, 5 figs. Device for determining line currents under different loading conditions.

ELECTRIC FURNACES

Booth Rotating. Booth Rotating Electric Furnace, Carl H. Booth. Metal Industry (N.Y.), vol. 18, no. 10, Oct. 1920, pp. 456-459, 5 figs. Description of furnace. Records of operation as obtained in installations ranging in size from 250 lb. to 2000 lb. per heat.

Greaves-Etchells. An Improved Greaves-Etchells Electric Furnace Installation, Edward T. Moore. Chem. and Metallurgical Eng., vol. 23, no. 17, Oct. 27, 1920, pp. 825-832, 21 figs. Description of Greaves-Etchells electric furnace and of arrangement of electrical equipment as installed at plant of Halcomb Steel Co. Records of operation.

Metal-Melting. Application of Electrical Energy to the Melting of Metals, H. A. Greaves. Jl. Instn. Elec. Engrs. (Supp.), vol. 57, part 2, Oct. 1920, pp. 250-253 and discussion pp. 276-305, 11 figs. Comparative study of different types of furnaces.

Operating Data. Electric Furnace Operating Data, C. H. Reeder. Eng. World, vol. 17, no. 5, Nov. 1920, pp. 452-455, 4 figs. Present and future prospects of electric furnaces. Figures showing various items of expense involved in melting of steel. Unit costs. Raw materials and finished product.

Refractories for. Electric Furnace Refractories, A. F. Greaves-Walker. Chem. & Metallurgical Eng. vol. 23, no. 19, Nov. 10, 1920, pp. 933-936. Description of raw materials available for highest grade brick with list showing recommended refractories for melting different metals and alloys, and hints on care, storage and laying of roofs, hearths and linings.

Steel Refining. Developments in Electric Iron and Steel Furnaces, J. Bibby. Jl. Instn. Elec. Engrs. (Supp.), vol. 57, part 2, Oct. 1920, pp. 231-246, 24 figs. Electric reduction furnace and steel refining furnace are taken up.

Large Electric Steel-Melting Furnaces, Victor Stobie. Jl. Instn. Elec. Engrs. (Supp.), vol. 57, part 2, Oct. 1920, pp. 268-276, 9 figs. Furnace requirements of a large steel plant.

United Kingdom. Electric Furnaces in the United Kingdom, 1918, R. G. Mercer. Jl. Instn. Elec. Engrs. (Supp.) vol. 57, part 2, Oct. 1920, pp. 254-264. Records of operation of electric furnaces used in manufacture of steel.

ELECTRIC GENERATORS, D. C.

Axle. Specification for Axle Generators. Ry. Elec. Engr., vol. 11, no. 10, Oct. 1920, pp. 367-370. Specification intended to cover axle-generator equipment for railway service. Committee report of Assn. of Elec. Engrs.

ELECTRIC LAMPS, ARC

Cooper Hewitt. The Cooper Hewitt Lamp—II, L. J. Buttolph. Gen. Elec. Rev., vol. 23, no. 10, Oct. 1920, pp. 858-866, 17 figs. Outlines development and some applications of lamp from 1901 to present time.

ELECTRIC LOCOMOTIVES

Crank Gear, Critical Speeds of. The Critical Speeds of Crank Gears of Electric Locomotives (Die kritischen Drehzahlen der Kurbelgetriebe elektrischer Lokomotiven), W. Kummer. Schweiz. elektrotechnischer Verein Bull., vol. 11, no. 9, Sept. 1920, pp. 237-242, 3 figs. Gives critical numbers of revolutions which can be expected in the case of so-called ideal crank gear; crank gear with deviation of rod lengths from distance of bearing center; and crank gear with play of bearings. It is pointed out that in the construction of large locomotives with parallel crank gears, the occurrence and prevention of critical speeds should be investigated by means of preliminary calculations.

Heavy Electric Traction. Report of the Committee on Heavy Electric Traction. Am. Elec. Ry. Eng. Assn., report no. 305, Oct. 11-15, 1920, 24 pp., 20 figs. Survey of recent developments and progress in design of motors and motor drives for heavy traction, both a.c. and d.c., with comparison of weight, space efficiency, etc.; description and illustrations of recent types of electric locomotives since report of 1916; and comparison of electric switching engines in freight yards with steam engines.

Italian State Railways. Three-Phase Electric Locomotive for the Italian State Railways. Eng., vol. 110, no. 2858, Oct. 8, 1920, pp. 469-471, 22 figs., partly on 4 supp. plates. Details of six three-phase 4-6-4 type electric locomotives built by Construzioni Meccaniche di Saronno of Milan. Working voltage is 3300. Maximum draw-bar pull is 26,000 lb.

Performance. Data on Electric Locomotive Performance. Elec. World, vol. 76, no. 18, Oct. 30, 1920, pp. 878-880, 1 fig. Advantages claimed for electric locomotive are economy of fuel, increased haulage, low maintenance and general flexibility. Graph showing coal consumption comparison on identical runs by steam and electric locomotives is included.

ELECTRIC METERS

Mean Intensity Indicator. Chromothermic Mean Intensity Indicator (Indicateur chromothermique d'intensité moyenne), Ch. Ed. O'Keenan. Revue générale de l'Electricité, vol. 8, no. 15, Oct. 9, 1920, pp. 493-497, 8 figs. A steel needle is heated by passage of current. Current intensity is determined from nature of coloration assumed by needle.

Standardization. Motor Features Requiring Standardization, C. W. Starker. Elec. World, vol. 76, no. 19, Nov. 6, 1920, pp. 919-921, 5 figs. Urges standardization of mechanical features of electrical motors.

ELECTRIC MOTORS, D. C.

Crane and Hoist Drive. Direct-Current Motors for Crane and Hoist Work, F. L. Moon. Elec. Jl., vol. 17, no. 11, Nov. 1920, pp. 532-535, 7 figs. Graphs showing comparative characteristics of enclosed and ventilated motors.

ELECTRIC PLANTS

Inspection. Scheduled Inspection for Power Plants, Elec. World, vol. 76, no. 19, Nov. 6, 1920, pp. 922-924, 2 figs. Forms for keeping records.

Interconnection. Interconnection of Power Systems, Harold W. Smith. Elec. Jl., vol. 17, no. 11, Nov. 1920, pp. 515-518, 4 figs. Comparative study of the various method of interconnecting generating stations.

ELECTRIC RAILWAYS

Buildings and Structures. Report of the Committee on Buildings and Structures. Am. Elec. Ry. Eng. Assn., report no. 309, Oct. 11-15, 1920, 17 pp., 7 figs. Inspection and maintenance of buildings and structures; lag screws vs. bolts in timber-decked structures; prepayment and postpayment collection of fares at terminals; review of existing standards and recommendations.

Current Standardization. Problems of the Electric Railway, G. Wuthrich. Engr., vol 130, no. 3377, Sept. 17, 1920, pp. 281-283, 1 fig. It is argued that extra high-tension low periodicity single-phase current system is alone capable of lending itself to immediate and simultaneous standardization for both suburban and main line traction.

Diesel-Electric Motor Cars. Diesel-Electric Motor Cars of the Swedish Railways (Automotrices pétroléo-électriques à moteur Diesel des chemins de fer suedois). Génie Civil, vol. 77, no. 16, Oct. 16, 1920, pp. 305-309, 16 figs. Used in local railways.

Equipment. Report of the Committee on Equipment. Am. Elec. Ry. Eng. Assn., report no. 311, Oct 11-15, 1920, 39 pp., 33 figs. Standards for brakeshoes, brakeshoe heads, and brakeshoe keys; feasibility of adopting standard cars.

Power Distribution. Report of the Committee on Power Distribution. Am. Elec. Ry. Eng. Assn., report no. 304, Oct. 11-15, 1920. 100 pp., 7 figs Specifications for overhead line material, electric light, power supply, trolley lines crossing steam and electric railroads, standard thread for pins and insulators, etc.

Power Generation. Report of the Committee on Power Generation. Am. Elec. Ry. Eng. Assn., report no. 308, Oct. 11-15, 1920, 60 pp., 5 figs. Recommended form of power contract for purchase of power; comparative cost of steam production for utilization in electric power plans from using coal, oil, gas or other special fuels; tabulation of costs of power generated by member companies.

Speed-Time Curves. Note on the Drawing of the Speed-Time Curves of Electric Trains, J. Musyck. Bul. Int. Ry. Assn., vol. 2, no. 9, Sept. 1920, pp. 581-590, 7 figs. Graphical method.

Trolley Contact Voltage. What Happens at the Trolley Contact? D. D. Ewing. Elec. Ry. Jl., vol. 56, no 17, Oct. 23, 1920, pp. 863-865. figs Results of tests under various operating conditions. Contact voltage graphs for various types of wheels are shown. Average power loss with 5-in. wheel was nearly ½ kw.

ELECTRIC RAILWAYS, TRACK

Circuiting. Alternating-Current Track Circuiting, L. H. Peter. Jl. Instn. Elec. Engrs., vol. 58, no. 292. June 1920, pp. 491-506, 30 figs. Distinction is made between "in phase" and "quadrature" relays, vector diagrams are given of track circuit without impedance bonds and phase displacement is obtained with two types of relays. Vector diagrams of track circuit with non-resonated and with resonated impedance bonds are also constructed. Method of varying the relay track-winding power factor is given and effect on vector diagram discussed.

Insulated Tools. Insulated Tools for Use on the Permanent Way of Electrified Railways. Ry. Gaz., vol. 33, no. 17, Oct. 22, 1920, pp. 541, 2 figs. Newly designed insulated tools, patented and manufactured by British Power Railway Signalling Co.

Track Welding. *See Electric Welding, Rails.*

Trackwork Specifications. Report of the Committee on Way Matters. Am. Elec Ry Eng. Assn., report no 310 Oct. 11-15, 1920, 95 pp., 13 figs. Recommended specifications for track spirals; standard sections for curved-head rails; revision of specifications for plain bolted special trackwork; specifications for wood-block paving; compilation of data on safe limits of wear in rails and special trackwork on life of track construction of various types.

ELECTRIC TRANSMISSION LINES

Characteristics. Electrical Characteristics of Transmission Circuits—XIII, Wm. Nesbit. Elec. Jl., vol. 17, no. 11, Nov. 1920, pp. 527-532, 3 figs. Comparative study of characteristics of various types.

High-Voltage. Notes on the Electrical Calculations of Long-Distance High-Voltage Transmission Lines, A. McKinstry. Jl. Instn. Elec. Engrs. (Supp.), vol. 57, part 2, Oct. 1920, pp. 92-117, 8 figs. Fundamental formulæ for transmission lines without branches. Study of constant voltage transmission.

Lightning Protection. *See Lightning Arresters.*

Long-Distance. Calculation, Diagrams and Regulation of Long Distance Electric Transmission Lines (Calculs, diagrammes et régulation des lignes de transport d'énergie à longue distance), L. Theilemans. Revue générale de l'Electricité, vol. 8, nos. 13, 14 and 15, Sept. 25 and Oct. 2 and 9, 1920, pp. 403-416, 435-443 and 475-482, 39 figs. Methods employed by writer in his practice as engineer of French Thomson-Houston Co. (To be continued.)

Switching and Protection. Switching and Protection of Transmission Circuits—III, S. Q. Hayes. Elec. Jl., vol. 17, no. 11, Nov. 1920, pp. 521-526, 7 figs. Exemplifies manner of proceeding by determining switching equipment needed in case of generating station containing fifteen 25,000-kva. vertical-shaft waterwheel generators.

Size of Wire. Determining Size of Wire and the Length of Span, D. F. Parrott. Elec. World, vol. 76, no. 19, Nov. 6, 1920, p. 928. No. 6 wire and 250-ft. span are said to be found economical for most cases where voltage lies between 33,000 and 66,000.

ELECTRIC WELDING

Methods. Electric Welding, Fred H. Williams. Jl. Eng. Inst. Canada, vol. 3, no 11, Nov. 1920, pp. 514-522, 12 figs. History and survey of electric welding methods. Account of research work by writer.

ELECTRIC WELDING, ARC

Effect on Eye. Effect of Ultra-Violet Rays on the Eye, C. R. Kindall. Reports of Investigations, Bur. of Mines, Dept. of Interior, serial no. 2173, Oct. 1920, 2 pp. Records of effect on eye of electric arc welding.

ELECTRIC WELDING, RESISTANCE

Spot-Welding Machines. Modern Welding and Cutting—XXXI, Ethan Viall. Am. Mach., vol. 53, no. 18, Oct. 28, 1920, pp. 807-821, 39 figs. Spot-welding machines.

ELECTRICAL SYMBOLS

International Standards. Electrical Symbols Proposed for International Adoption. Elec. World, vol. 76, no. 20, Nov. 13, 1920, pp. 971-972. Complete set adopted by Advisory Committee for consideration of next plenary meeting of international electrotechnical commission.

EMPLOYMENT MANAGEMENT

Bibliography. A Guide and Bibliography for Labor Managers, Leverett S. Lyon and May R. Freedman. Indus. Management, vol. 60, no. 5, Nov. 1920, pp. 383-385.

Interviewing Workers. The Art of Interviewing Workers, J. D. Hackett. Indus Management, vol. 60, no 5, Nov. 1920, pp. 338-340. Qualifications necessary in an interviewer, and essential steps in interviewing.

Vocational Classification of Employees. Making it Easy to Find the Right Technical Men, I. W. Litchfield. Factory, vol 25, no. 8, Oct. 15, 1920, pp. 1232-1234, 2 figs. Suggests methods of classifying employees by industry and by function.

EMPLOYEES' REPRESENTATION

Shop Committees. The Operation of the Whitley Councils. Metal Industry (N.Y.), vol. 18, no. 10, Oct. 1920, p. 470. History, development and present state of England's experiment in co-operation between employer and employee. (Concluded.)

Workmen's Representation in a Tool Manufacturing Plant. Machy. (Lond.), vol. 17, no. 422, Oct. 28, 1920, pp. 111-115, 1 fig. Shop committee plan of Greenfield Tap & Die Corp. which operates six plants in U. S.

ENGINEERING SOCIETIES

The Federated American Engineering Societies. The Engineering Educator's Opportunity in Engineering Organization, William E. Bullock. Eng. Education, Bul. Soc. Promotion of Eng. Education, vol. 11, no. 2, Oct. 1920, pp. 72-75. Scheme of organization of engineering profession by means of Federated American Engineering Societies is explained. Plan of federation contemplates formation of all-inclusive local societies of engineers in important communities and their organization into federation for action on matters dealing with public service.

ENGINEERS

Fees and Salaries. Recommended Salaries for Manitoba Engineers. Contract Rec., vol. 34, no. 44, Nov. 3, 1920, pp. 1046-1047. Report on remuneration of engineers submitted by Salary Committee of Manitoba Branch of Engineering Institute of Canada.

Various Schedules of Fees for Consulting Engineers Edmund I. Mitchell. News-Rec., vol 85, no 20, Nov 11, 1920, pp. 941-942. Compiled by Edmund I. Mitchell, Assistant Secretary of Committee on Classification and Compensation of Engineers, Engineering Council. New York City, with aid of Engineering Societies' Library.

Registration. Report of Committee to the Minnesota Joint Engineering Board-Recommended Registration Law. Bul. Affiliated Eng. Soc. of Minnesota, vol 5, no. 10, Oct. 1920, pp. 18-26. Suggested text of act to regulate practice of architecture, professional engineering and land surveying in Minnesota.

EXCAVATION, EARTH

See Shovels, Rotary.

EXCAVATORS

Development of. Recent Excavator Practice, F. H. Livens and W. Barnes. Jl. Instn. Mech. Engrs., no. 6, Oct. 1920, pp 609-630 and (discussion) pp. 631-637, 16 figs. Survey of progress in development of types, with special reference to the steam-navy.

Dragline. Storm Sewer Construction with a Dragline Excavator. Excavating Engr. vol 14, no. 9. Nov. 1920 pp. 295-296. Description of excavation of large storm sewer in Detroit with dragline excavator. Method of handling forms.

F

FACTORY MANAGEMENT

See Industrial Management.

FATIGUE

Industrial. The Speed of Adaptation of Output to Altered Hours of Work, H. M. Vernon. Eng. and Indus. Management, vol 4. no 15. Oct. 7, 1920, pp. 450-451. Data on evidence obtained at British munition factories during war. (Abstract.) Report of British Industrial Fatigue Research Board.

FILTRATION PLANTS

Operation. Filter Underdrain, Sand-Bed and Washwater Experience. Eng. News-Rec., vol. 85, no. 20. Nov 11, 1920, pp. 934-939. Symposium on current practice and operating success with various details of mechanical or rapid water filtration plants. (To be continued.)

FIRE BOATS

Diesel-Electric vs. Steam. Diesel-Electric Propulsion Versus Steam for Fire-Boats, William H. Easton. Motorship, vol. 5, no. 11, Nov. 1920, p. 997. Diesel electric is found more advantageous.

FLOW OF FLUIDS

Pipe Lines. Effect of Fittings on Flow of Fluids Through Pipe Lines, E. Foster. Mech. Eng., vol. 42, no. 11, Nov. 1920, pp. 616-618, 11 figs. Graphical solution of Babcock's formula for flow of steam in pipe lines. Table giving equivalent lengths of standard pipe to allow for various screw fittings in conduits carrying non-viscous liquids, steam, air or gas.

FLOW OF WATER

Drain Tiles. New Formula for Flow of Water in Drain Tile. Eng. and Contracting, vol. 54, no. 15, Oct. 13, 1920, pp. 374-375, 1 fig. Formula derived from experiments in which 824 separate tests were made. From Bulletin 854 of U. S. Dept. of Agriculture.

Manning's Formula. Charts for Solution of Manning's Hydraulic Formula, Elmo G. Harris. Eng. News-Rec., vol. 85, no. 18, Oct. 28, 1920, pp. 837-839, 2 figs.

Theory of. On a Theory of Fluid Friction and Its Application to Hydraulics, E. Parry. English Elec. Jl., vol. 1, no. 4, Oct. 1920, pp. 146-164, 4 figs. Generalisation of theory of fluid friction employed in aeronautics to flow of water in pipes and conduits. Table giving values of coefficient in Chézy's formula for flow of water in pipes and conduits.

FORGING

Recording Apparatus. The Solution of Forging Problems, Eugene Schneider. Eng. & Industrial Management, vol. 4, no. 17, Oct. 21, 1920, pp. 520-525, 2 figs. Schneider apparatus for recording times and pressures employed during forging in relation to the stroke.

FOUNDRIES

Accidents in. *See Accidents, Foundries.*

Brass. Reclamation of Metal from Brass-Foundry Refuse, F. L. Wolf and G. E. Alderson. Metal Industry (N.Y.), vol. 18, no. 10, Oct. 1920, pp 452-455, 2 figs. Records of costs and returns obtained in reclaiming plant used at Ohio Brass Co. Paper read before Inst. of Metals Division.
See also Railway Shops, Brass Castings for.

U. S. and Canada. Growth Marks Reconstruction Era. Foundry, vol. 48, no. 21, Nov. 1, 1920, pp. 853-858, 7 figs. List of foundries in United State and Canada in 1920 and 1918 by States and Provinces.

FUELS

Coal vs. Oil. *See Coal, Oil vs.*

Diesel-Engine. *See Diesel Engines, Fuels.*

FURNACES, BOILER

Forced Draft. Draft Regulation in Forced-Draft Boiler Furnaces (Windregelung bei Unterwindfeuerungen), H. Pradel. Zeit für Dampfkessel u. Maschinenbetrieb, vol. 43, no. 36, Sept. 3, 1920, pp. 273-275, 5 figs. Details of air-current regulator developed by German Evaporator Co., Ltd., by means of which air admitted into every chamber can be regulated.

FURNACES, ELECTRIC

See Electric Furnaces.

FURNACES, HEAT-TREATING

Insulation. The Function of Insulation and its Application to Heat-Treating Furnaces. E. F. Davis. Trans. Am. Soc. for Steel Treating, vol. 1, no. 1, Oct. 1920, pp. 33-42, 4 figs. Formulæ and graph for designing insulation.

FURNACES, OPEN-HEARTH

Efficiency. Increased Efficiency in the Open-Hearth, Philip C. Gunion. Blast-Furnace & Steel Plant, vol. 8, no. 11, Nov. 1920, pp. 624-625 and p. 635, 3 figs. Effect roller bearings applied to rolling stock has upon reducing transportation costs. Comparative tests made with cars of plain bearing type.

Port Design. Design of Ports for Open-Hearth Furnaces, Herbert F. Miller, Jr. Blast-Furnace & Steel Plant, vol. 8, no. 11, Nov. 1920, pp. 612-614, 3 figs. Circular water cooled ports used by Lackawanna Steel Co.

G

GAGES

Laboratory Standards. Sizes of the N. P L. End Standards in English Units. Eng. vol. 110, no. 2858, Oct. 8, 1920, p. 474. Changes which have been made in accepted sizes of laboratory end standards at National Physical Laboratory, England.

Lapping. *See Lapping.*

Precision. Precision Gages, M. E. Kanek. Am. Mach., vol. 53, no. 20, Nov. 11, 1920, pp. 884-886. Methods of accurate measurement, and methods of manufacturing precision gages.

Precision Measuring and Inspection Devices—II, R. J. Whibley. Machy, (N.Y.), vol. 27, no. 3, Nov. 1920, pp. 242-245, 6 figs. Minimeter and gage comparator used by National Physical Laboratory, England, for inspecting precision gage-blocks. Devices permit readings to accuracy of one millionth of an inch.

Thread. Adjustable Thread Snap Gauge. Eng., vol. 110, no. 2860, Oct. 22, 1920, p. 551, 3 figs. Constructed by Coventry Gauge & Tool Co., Ltd., Engineers, Coventry.

GARBAGE DISPOSAL

Methods. Transportation of Garbage with Data on Garbage Disposal in Various Cities, Samuel A. Greeley. Mun. & County Eng., vol. 59, no. 4, Oct. 1920, pp. 132-134. Tables showing method of garbage disposal in 50 of largest cities in U. S.

GAS MAINS

Steel vs. Cast Iron. Steel Versus Cast-Iron for Gas Mains, B. R. Parkinson and Norton H. Humphrys. Gas World, vol. 73, no. 1891, Oct. 16, 1920, pp. 299-300. Opinions of representative engineers.

GAS MANUFACTURE

Regulations in France. New Regulations for the Quality of Illuminating Gas, and New Methods of Manufacture (Nouvelles règles fixant les qualités exigées du gaz d'éclairage, et nouvelles méthodes de fabrication), P. Lauriol. Génie Civil, vol. 77, no. 17, Oct. 23, 1920, pp. 328-329. Suppression of tests of illuminating power and permission to add water gas.

GAS MASKS

Uses in Mines. Danger in Using Army Gas Masks in Mines, George S. Rice. Reports of investigations, Bur. of Mines, Dept. of Interior, serial no. 2175, Oct. 1920, 2 pp. Instances of failure of army gas mask.

GAS PRODUCERS

German. Modern Development of Fuel Gasification, Hubert Hermanns. Blast-Furnace & Steel Plant, vol. 8, no. 11, Nov. 1920, pp. 617-624, 13 figs. Development of modern gas producers in Germany. Operation of producer and processes by which complete utilization of all constituents are obtained.

GAS WORKS

Motive Power. Notes on Operating a By-Product Producer Gas Plant for Power and Heating, W. H. Patchell. Jl. Instn. Elec. Engrs., vol. 58, no. 292, June 1920, pp. 417-430 and (discussion) pp. 437-463, 4 figs. Extension of gas works of Hoffmann Manufacturing Co., Ltd., England.

Waste Disposal. Disposal of Waste from Gas Plants. Am. Gas Eng. Jl., vol. 113, no. 19, Nov. 6, 1920, pp. 363-366. Report of American Gas Association 1920 Committee.

GASOLINE

Carburation of. The Carburation of Gasoline, O. C. Berry and C. S. Kegerreis. Purdue University, Publications of Eng. Depts., vol. 4, no. 1, April 1920, 223 pp., 103 figs. Results of tests carried out to determine richness of fuel to air mixture required by engine under different running conditions in order that it may develop either maximum power or maximum efficiency.

Cracking Manufacturing Practice. Gasoline Cracking Processes, Fred W. Padgett. Chem. & Metallurgical Eng., vol. 23, no. 19, Nov. 10, 1920, pp. 908-913. Description of commercial methods for production of gasoline by pyrolytic distillation of heavy hydrocarbons, including Burton, Greenstreet, Hall, Rittman, Aluminum Chloride, Dubbs, Jenkins, and Bacon processes. List of inventors, patent numbers and dates.

GASOLINE ENGINES

Horsepower Diagram. Diagram to Determine Horsepower of Gasoline Engines, C. E. Lounsberg. Eng. News-Rec., vol. 85, no. 19, Nov. 4, 1920, pp. 892-893, 1 fig. It is held that Swedish formula is best for purpose.

GEARS

Automobile. Fixtures for Testing Automobile Gears. Machy, (N.Y.), vol. 27, no 3, Nov. 1920, pp. 270-273, 8 figs. Methods used at various plants.

Teeth in Contact. Derivation of a Formula to Determine Number of Teeth in Contact of Two Meshing Gears, A. B. Cox. Am. Mach., vol. 53, no. 20, Nov. 11, 1920, pp. 899-902, 10 figs. Formula is derived and graphic representation of results of application of this formula are shown.

GIRDERS

Design. The Stresses in Portals and Similar Structures, Talbot C. Broom. Engr., vol. 130, nos. 3381 and 3382, Oct. 15 and 22, 1920, pp. 368-369, 5 figs., and 393-394, 5 figs. Suggests simplification in design of continuous girders.

GLASS

Expansion at High Temperatures. The Expansion of Glass at High Temperatures, W. B. Pietenpol. Chem. & Metallurgical Eng., vol. 23, no. 18, Nov. 3, 1920, pp. 876-877, 1 fig. Thermal expansion curves of unannealed light barium crown glass.

GOLD METALLURGY

Recovery from Black Sand Tailings. Recovery of Gold from Black Sand Tailings, John Gross. Reports of Investigations, Bur. of Mines, Dept. of Interior, serial no. 2170, Oct. 1920, 2 pp. Tests conducted at Alaska station of Bur. of Mines.

GOLD MINING

Southern U.S. Gold Mining in the Southern States, H. A. Megraw. Eng. & Min. Jl., vol. 110, no. 20 Nov. 13, 1920, pp. 938-940, 1 fig. Recent development of mines in that section hindered by absence of mining code, lack of mining experience, and failure to recognize limitations.

GRINDING

Automobile Parts. Cadillac Grinding Practice. Machy. (Lond.), vol. 17, no. 420, Oct. 14, 1920, pp. 33-37, 9 figs. Methods employed in grinding department of plant building Cadillac cars.

GRINDING MACHINES

High-Speed. Grinding at Speed of 100,000 Revolutions per Minute. Can. Machy., vol. 24, no. 16, Oct. 14, 1920, p. 365. Editorial comment on machine produced by British manufacturer which is said to be capable of running safely at 100,000 r.p.m.

H

HARMONICS

Analysis. A Practical Method of Harmonic Analysis, Philip Kemp. Jl. Instn. Elec. Engrs. (Supplement), vol. 57, part 2, Oct. 1920, pp. 85-91. Schedule for routine work in analysis of periodic wave forms.

HEATING AND VENTILATION

Psychrometric Chart. Phychrometric Chart, E. V. Hill. Heating and Vent. Mag., vol. 17, no. 10, Oct. 1920, pp. 50-51, 1 fig. Issued by Chicago Department of Health.

Schools. New Heating and Ventilating System Adopted for Chicago Schools—I. Domestic Eng., vol. 93, nos. 6 and 7, Nov. 6 and 13, 1920, pp. 251-253, 3 figs., and 300-302, 14 figs. Plan recently evolved by chief engineer of Chicago Board of Education.

HEAVY-OIL ENGINES

Reciprocating Parts for. Reciprocating Engine Crosshead Design Applied to Heavy-Oil Engines, W. D. Forbes. Marine Eng., vol. 25, no. 11, Nov. 1920, pp. 924-925. Service requirements.

HOSE

Steam. Steam Hose Construction, John M. Bierer. India-Rubber Jl., vol. 60, no. 15, Oct. 9, 1920, pp. 9-10. Results obtained from tests by B. F. Goodrich Co. Hose constructed according to different processes were compared.

HOUSES

Electrical Equipment. The Electrical Equipment of Artisan Dwellings, Leonard Milne. Jl. Instn. Elec. Engrs., vol. 58, no. 292, June 1920, pp. 464-467 and (discussion), pp. 476-490. Cost figures for electrical equipment supply to houses erected under British Government Housing scheme.

HOUSES, CONCRETE

Construction. Concrete Cottage Building. Concrete and Constructional Eng., vol. 15, no. 10, Oct. 1920, pp. 668-673, 7 figs. Patent system of construction approved by British Ministry of Health.

HOUSING

France. Low-Priced Houses (La construction d'habitations à bon marché), Paul Razous. Génie Civil, vol. 77, no. 16, Oct. 16, 1920, pp. 309-313. Housing projects for Paris and suburbs.

HUMIDITY

See Heating and Ventilation, Humidity Regulator; Psychrometric Chart.

HYDROELECTRIC PLANTS

New Brunswick, Canada. Hydro-Electric Power Development in New Brunswick, C. O. Foss. Jl. Eng. Inst. Canada, vol. 3, no. 11, Nov. 1920, pp. 522-525. Outlines work at Musquash River and Shogomac developments.

Niagara Falls Power Development. Clearing House for Five Stations, J. Allen Johnson. Elec. World, vol. 76, no. 20, Nov. 13, 1920, pp. 961-965, 12 figs. Semi-outdoor substation of Niagara Falls Power Co. Combined output of installations is rated at 400,000 hp.

Norway. Vamma Hydro-Electric Plant. Engr., vol. 130, no. 3379, Oct. 1, 1920, pp. 324-326, 3 figs. Plant, when completed, will develop 200,000 hp. on head of from 80 ft. to 85 ft.

I

IGNITION

Alsop Device. Test of the Alsop All-Spark Ignition Device. Air Service Information Circular, vol. 1, no. 18, Sept. 15, 1920, 4 pp., 1 fig. Device is subsidiary spark gap which is inserted in high-tension circuit of ignition system.

Sparking Performance of System. The Effect of Shunted Resistance, or Plug Leakage, on the Sparking Performance of an Electrical Ignition System, G. E. Bairsto. Jl. Instn. Elec. Engrs, vol. 58, no. 292, June 1920, pp. 507-522, 22 figs. Tests made at Royal Aircraft Establishment, Farnborough, England, during 1917 to 1918, to determine effect of shunted resistance on spark voltage of most of leading types of electrical ignition systems in use. It was found that the quicker the rate of rise of secondary potential the less is fall of voltage with leakage. Following order of merit of various types was established: (1) rotating armature types with movable pole-shoes, (2) ordinary rotating-armature types, (3) sleeve inductor types, (4) polar inductor types; and (5) battery and coil systems.

Tests. Ignition from the Engineman's Viewpoint, George E. A. Hallett. Jl. Soc. Automotive Engrs., vol. 7, no. 5, Nov. 1920, pp 475-479, 7 figs. Test results of single and double ignition systems on Liberty engine.

INDUSTRIAL MANAGEMENT

Inspection. Inspection: The Control of Quality—III, George S. Radford. Indus. Management, vol. 60, no. 5, Nov. 1920, pp. 331-335. Comparative study of various methods of inspection, such as centralized inspection, floor inspection, inspection of work in process, sampling, double inspection, pilot part tests, etc.

Opinions of Workers. What the Workers Think About Management—I, Albert Fry. Indus. Management, vol. 60, no. 5, Nov. 1920, pp. 322-327 Views of labor turnover, rate setting and managing men by ironworkers, carpenters, inspectors, blacksmiths, machinists, patternmakers and others.

Payroll Graph. Graphic Planning of Payroll Procedure, W. C. Bober. Indus. Management, vol. 60, no. 5, Nov. 1920, pp. 336-337, 1 fig. Chart based on labor routine of Mechanical Rubber Co., Cleveland.

Planning Department. New Department in Detroit Plant, Don F. Kennedy. Iron Age, vol. 106, no. 19, Nov. 4, 1920, pp. 1177-1179. Duties of factory planning engineer at Timken-Detroit Axle Co.'s Detroit plant.

Planning Department Systems, John H. Van Deventer. Indus. Management, vol. 60 no. 5, Nov. 1920, pp. 373-376, 4 figs. How to visualize methods by mapping routine.

Production Systems. How a Factory Diplomat Aids Production. Factory, vol. 25, no. 9, Nov. 1, 1920, pp. 1398-1400, 1 fig. Production methods of foundry in Illinois.

Modern Production Methods, W. R. Basset. Am. Mach., vol. 53, nos. 18 and 20, Oct. 28 and Nov. 11, 1920. pp. 798-802, 3 figs., and 889-891, 2 figs. Fundamental definitions and explanations of cost subdivision. Nov. 11: Method of allotting fixed charges to every department.

Routing Materials. Routing Considered as a Function of Up-to-Date Management—II, H. K Hathaway. Indus Management, vol 60, no. 5, Nov. 1920, pp. 353-361, 10 figs. How to proceed when product consists of several parts.

Shipyards. Scientific Management in a Large French Shipyard—I, M. Lavallée. Eng. & Industrial Management, vol. 4, nos. 17 and 18, Oct. 21 and 28, 1920, pp. 515-519, 1 fig., and 547-553, 7 figs. Results obtained in 1914 at Penhoet Shipyard at St. Nazaire, France. From Bulletin de la Société d'Encouragement pour l'Industrie Nationale.

INDUSTRIAL RELATIONS

Employees' Magazines. Making the Plant Paper Pay, Edwin A. Hunger. Indus. Management, vol. 60, no. 5, Nov. 1920, pp. 341-344. Suggestions to editors of employees' magazines.

Employers' Control. Italy's Soviet Shows Weakness, Francis Miltoun. Iron Trade Rev., vol. 67, no. 19, Nov. 4, 1920, pp. 1271-1272. Collapse of short-lived uprising of workers in steel plants and factories is pointed out as illustrating interdependence of capital and labor.

Open Shop Movement in U. S. Cleveland in Open-Shop Ranks. Iron Trade Rev., vol. 67, no. 19, Nov. 4 1920, pp. 1264-1265. It is reported American plan Association has been organized, with fully 70 per cent of employers co-operating.

Employees Uphold the Open Shop, A. J. Hain. Iron Trade Rev., vol. 67, no. 16, Oct. 14, 1920, pp. 1071-1076, 7 figs. How International Association of Machinists failed to obtain general advance of 25 per cent in wages for which it fought for a year at Cincinnati machine tool plants.

Public Sponsors Open-Shop Associations. Iron Trade Rev., vol. 67, no. 20, Nov. 11, 1920, pp. 1339-1345 and pp. 1348-1350, 5 figs. It is reported that American Federation is to be established soon. Purpose of federation will be to secure and establish open-shop principle in industrial relations.

Open Shops, Arguments in Favor of. The Human Factor in Industry, Alexander Ramsay. Jl. Inst. Mech. Engrs., no. 6, Oct. 1920, pp. 709-715 and (discussion) pp. 716-729. Urges employers to cultivate more open shop policy.

Settlement of Disputes. The Settlement of Labor Disputes, Henry J. Allen. Elec. Ry. Jl., vol. 56, no. 16, Oct. 16, 1920, pp. 751-753. Experience in Kansas cited to illustrate fundamental relations of workers and public welfare.

Unionized Shops. An Example of Putting Friendliness into a Unionized Shop, Harry Tipper. Automotive Industries, vol. 43, no. 18, Oct. 28, 1920, pp. 882-883. Writer quotes from English employer to show that open shop is not necessary to arrive at complete accord between workers and management

Whitley Shop Councils. *See Employees' Representation, Shop Committees.*

INDUSTRIAL TRUCKS

Steel Industry. Trucks Win Place in Steel Traffic as Railroads Fail, Myers L. Feiser. Iron Trade Rev., vol. 67, no 17, Oct. 21, 1920, pp. 1127-1129, 5 figs. Steel carried in motor trucks from mill to consumer or to car for shipment to consumer is estimated at more than 100,000 tons monthly.

INDUSTRY

Australia. The Industrial Development of Australia, Ernest L. Little. Am. Mach., vol 53, no. 19, Nov. 4, 1929, pp. 842-843. Statistics showing progress within last ten years.

Mexico. Mexico's Industrial Progress Since Diaz, John E. Kelly. Eng. & Min. Jl., vol. 110, no 20, Nov. 13, 1920. pp 941-943. Nearly all railroad construction now under way planned under Cararuza. Oil exports tripled in seven years. Metal output during revolutionary period indicative of mining activities.

INSULATORS

European Practice. Features of European Insulator Testing Practice, B Schapira. Elec. Rev., (Chicago), vol 77, no. 19, Nov. 6, 1920, pp 721-724, 8 figs. Two-part insulators of pin type are used for service below 70,000 volts. Tests are made of electrical and mechanical properties of individual parts and complete assembled units. Testing practice as carried on in Schomburg Works at Margarethenhutte, Germany.

High-Voltage. Surface Creepage and High-Voltage Insulation, T. Nishi. Jl. Am. Inst Elec. Engrs, vol 39, no 11, Nov 1920, pp. 949-959, 32 figs. Experiments made in Electrical Engineering Laboratory in Tokyo Imperial University and in High-Voltage Laboratory of Leland Stanford Junior University. It is concluded that main cause of erratic surface creepage is accumulation of free charge on surface of dielectric of which bushings insulators, etc., are made.

Testing. Testing Insulators in Factory and Field, Leslie N. Crichton. Elec. Jl., vol. 17, no. 11, Nov. 1920, pp. 506-509, 10 figs. Methods of Westinghouse Elec. & Mfg Co.

INTERCHANGEABLE MANUFACTURE

Selective Assembly vs. Manufacturing for Selective Assembly, Earle Buckingham. Machy. (Lond.), vol. 17, no. 421, Oct. 21, 1920, pp. 82-83, 2 figs. Comparison of interchangeable and selective assembly manufacturing methods. Dimensions and tolerances on drawings for manufacturing on selective assembly basis.

IRON CASTINGS

Cleaning with Sand Blast. The Sand Blast in the Foundry, O Bertoya. Metal Industry (Lond.), vol. 17, no. 17, Oct. 22, 1920, pp. 321-323, 9 figs. Comparative tests of time required to clean castings by hand and by sand blasting.

Standardization of. Standardizing of Gray Iron Samples, Edward J. Fowler. Foundry, vol 48, no. 21, Nov. 1, 1920, pp. 876-877. It is said that lack of recognized standards which specify method of taking samples of gray iron castings for test purposes greatly impairs work of laboratory.

IRON METALLURGY

Direct Process. A Direct Process for Making Iron and Steel from Ore, James W. Moffat. Iron and Steel of Can., vol. 3, no. 9, Oct. 1920, pp. 271-274, 3 figs. Process patented by writer in which reduction is accomplished in separate mechanism and melting down of metal and its subsequent refining take place in electric furnace. Blast-furnace is eliminated and metal reduced from ores of all types. Process is said to be applicable to certain non-ferrous metals.

IRON ORE

Canadian. Iron Ores of Commerce with Special Reference to Canadian Deposits, Samuel Groves. Iron and Steel of Can., vol. 3, no. 9, Oct. 1920, pp. 267-270, 1 fig. Classification of commercial iron ores. (To be continued.) Report of Ontario Bureau of Mines.

IRRIGATION

Canada. The Legal Phases of Irrigation Development in Alberta, H. B. Muckleston, Jl. Eng. Inst. Canada, vol. 3, no. 11, Nov. 1920, pp. 510-514. History of irrigation law in general, developments in Alberta, and procedure under present laws.

Washington State. Unprecedented Design Involved in Irrigation Project. Eng. News-Rec., vol. 85, no. 20, Nov. 11, 1920, pp. 944-946, 2 figs. To bring water 130 miles to 1,753,000-acre Columbia basin in Washington. Viaduct, siphons and tunnels of unusual size.

L

LABOR

International Action Affecting. Historical Survey of International Action Affecting Labor. U. S. Dept. of Labor, Bur. of Labor Statistics, no. 268, Aug. 1920, 294 pp. Includes brief account of international political labor movement as seen in early International and its later organization as International Socialist Bureau. Describer briefly international trade-union movement, international organizations of "social reformers," interested in labor problems, considering particularly International Association for Labor Legislation, and recounts efforts of Governmental conferences to arrive at agreements as respects control of labor conditions within therir respective jurisdictions. Analysis is made of treaties and conventions entered into by various Governments. Survey covers international work up to 1914.

LAPPING

Modern Practice. Modern Lapping Practice, Edward K. Hammond. Machy. (N.Y.), vol. 27, no. 3, Nov. 1920, pp. 209-217, 19 figs. Review of developments in lapping practice including abrasives used and lap-charging methods, lapping thread gages, snap gages, measuring wires, flat surfaces, ring gages, die-casting dies, T-slots, etc.

LATHES

Turret. Tooling Acme Turret Lathes. Machy, (Lond.), vol. 17, no. 419, Oct. 7, 1020, pp. 1-3, 12 figs. Tooling equipment for performing turret-lathe operations on friction pulleys, aluminum pistons, gear blanks and other machine parts.

Turret Lathe Design and Construction. Mach' (Lond.), vol. 17, no. 420, Oct. 14, 1920, pp. 41-44, 5 figs. Based on examination of four American and one English machines.

LIGNITE

Briquetting. The Briquetting of Lignites, R. A. Ross. Dominion of Canada, report no. 1, 1918, 29 pp. Procedure and equipment are recommended.

LIGHTING

Bibliography. Illumination Bibliography Trans Illuminating Eng Soc, vol 15, no. 7, Oct 9, 1920, pp 385-391 Prepared by Committee on education of Illuminating Eng Soc. It covers books published in recent years up to June 1920.

Developments. Report of the Committee on Progress Trans Illuminating Eng Eng Soc, vol 15, no. 7, Oct 9, 1920, pp 425-493 Extensive survey of recent developments in gas and electric light

Industrial. Industrial Lighting, Ward Harrison and H H Magdsick. Bul Eng. Dept Nat Lamp Works, Gen. Elec Co., bul no 20a, Sept 10, 1919, 95 pp, 79 figs. Requirements which must be fulfilled in design of satisfactory installations. Data on Mazda lamps. Discussion of reflecting and diffusing equipment. Study of lighting of yards and foundries. Cost data of industrial lighting.

Modern Industrial Lighting for Oregon, F H Murphy. Elec World, vol. 76, no. 17, Oct. 23, 1920, pp. 820-823, 5 figs. Features of industrial lighting code adopted by Oregon. Provision is made for raising standards as better lighting practice develops.

Proper Lighting Means Efficiency, James Brakes, Jr. Iron Trade Rev, vol. 67, no. 16, Oct. 14, 1920, pp. 1061-1062 and 1067, 2 figs. Self-cleaning lamp fixtures. (Abstract) Paper read before Am. Foundrymen's Assn.

Machine Shops. Illumination of Machine Tools, G. Wagschal. Elec. World, vol 76, no. 19, Nov. 6, 1920, pp. 925-926, 4 figs. Sufficient illumination is said to be obtained over machines with intensity of 15.35 ft. candles in plant of Central Gear Co.

Stores. Store Lighting, Bul. Eng. Dept. Nat. Lamp Works, Gen. Elec. Co., bul. no. 29, June 5, 1917, 40 pp., 14 figs. Discussion of various types of lighting systems with suggestions and tables of particular application in store-lighting problems.

Street. Street Series Alternating-Current Incandescent Lamp Circuits. Bul. Eng. Dept. Nat. Lamp Works, Gen. Elec. Co., bul. no. 25, Sept. 20, 1915, 23 pp. 11 figs. Factors in design and operation of streets series incandescent systems.

Street Series Mazda Lamps. Bul. Eng. Dept. Nat. Lamp Works, Gen. Elec. Co., bul. no. 11C, Oct. 15, 1915, 10 pp., 6 figs. Characteristic curves of Mazda street series lamp.

LIGHTNING PROTECTION

4000-Volt Circuits. Lightning Protection of 4000-volt lines, Thomas Commerford Martin. Elec., World, vol. 76, no. 20, Nov. 13, 1920, pp. 972-977, 5 figs. Experimental investigation showed that density of lightning arresters on an electrical distribution system is far more important than type of arrester.

Studies in Lightning Protection on 4000-Volt Circuits—II. D. W. Roper. Jl. Am. Inst. Elec. Engrs., vol. 39, no. 11, Nov. 1920, pp. 960-975, 20 figs. Factors which affect lightning arrester performance. Curves showing relative merits of various types of lightning arresters.

Spark Gaps. Lightning Arrester Spark Gaps II, Chester T. Allcutt. Jl. Am. Inst. Elec. Engrs., vol. 39, no. 11, Nov. 1920, pp. 939-943, 12 figs. Data giving discharge characteristics of commercial type of impulse gap under different conditions. Factors that determine degree of protection afforded by lightning-arrester spark gap. Definition of "protection factor" and curves giving protection factor of certain types of gap.

Tests. Life and Performance Tests of O F Lightning Arresters, N. A. Lougee. Jl. Am. Inst. Elec. Engrs., vol. 39, no. 11, Nov. 1920, pp. 944-948, 5 figs. Performed at laboratories of General Electric Co.

LIME

Manufacture. The Manufacture of Lime for Chemical and Metallurgical Purposes —III, Richard K. Meade. Chem. & Metallurgical Eng., vol. 23, no. 19, Nov. 10, 1920, pp. 929-933, 3 figs. Methods of heating rotary kilns. Description and comparison of pulverized coal and producer gas installations. Boilers in series with kiln. Power consumption. Cost data.

LOCOMOTIVE BOILERS

Welding Flue Points to Boiler Tubes. Welding Flue Points to Boiler Tubes, Charles W. Geiger. Welding Engr., vol. 5, no. 10, Oct. 1920, pp. 44-46, 5 figs. Method developed by Charles S. Coleman of Santa Fe Railroad Co.

LOCOMOTIVES

Boosters. Operating Tests of a Pacific Type Booster Locomotive. Ry. Age, vol. 69, no. 17, Oct. 22, 1920, pp. 699-702, 6 figs. Additional tractive effort of booster has increased tonnage rating for division on New York Central.

Cylinder Parts. Cast Iron for Locomotive-Cylinder Parts, C. H. Strand. Technologic Papers, Bur. of Standards, no. 172, Sept. 11, 1920, 25 pp., 10 figs. Records of investigation of mechanical, chemical and metallographic properties of packing rings of various service mileages, and also of arbitration test bars, chill test blocks, and miscellaneous samples from various makers. It is concluded that existing specifications are insufficiently rigid as to requirements for mechanical tests and specification is proposed with revisions in accordance with results of these tests.

Mountain Type. Mountain Type Locomotives for the New Haven. Ry. Mech. Engr., vol. 94, no. 11, Nov. 1920, pp. 685-688, 8 figs. Equipment includes feedwater heaters and provision for future application of booster.

Oil-Burning. English Railways Experiment with Fuel Oil Ry. Mech. Engr., vol. 94, no. 11, Nov. 1920, pp. 692-696. Description of Scarab fuel oil-burning apparatus tested on London and North-western Ry.

Repair Shops. Large Shop Marks Development of Western Road. Ry. Age, vol. 69, no 17, Oct. 22, 1920, pp. 687-690, 6 figs. Locomotive repair shops of Union Pacific Railroad at Cheyenne, Wyo.

Locomotive Repair Shop Organization and Methods. Ry. Engr., vol. 41, no. 489, 1920, pp. 410-412. Best method of obtaining maximum output, consistent with good work, from locomotive repair shops.

Wheel Balancing. Locomotive Wheel Balancing Machine. Ry. Mech. Engr., vol. 94, no. 11, Nov. 1920, pp. 719-720, 5 figs. Device used in British railroad shops tests wheels by rotating them in spring supported bearings.

M

MACHINE TOOLS

Developments. Recent Machine Tool Developments—XVI, Joseph Horner. Eng., vol. 110, no. 2859, Oct. 15, 1920, pp. 494-498, 16 figs. Milling machines.

Plants. Service Department in a Machine Tool Plant. Machy. (N.Y.), vol. 27, no. 3, Nov. 1920, pp. 261-263, 3 figs. Outline of purpose, organization, equipment and methods of service department of Heald Machine Co., Worcester, Mass.

Safety Standards. Safety Standards of the Industrial Board. Commonwealth of Pennsylvania, Dept. of Labor & Industry, vol. 1, no. 5, 7 pp. Rules to safeguard workers in industries in which machine tools are used.

MAGNETIC TESTING

Defectoscope. New Magnetic Testing Apparatus. Iron Age, vol. 106, no. 18, Oct. 1920, pp. 1125-1128, 7 figs. Defectoscope, a device for magnetic testing of steel.

MALLEABLE CASTINGS

Manufacture in Electric Furnace. Malleable Made by Triplex Process, H. A. Schwartz. Foundry, vol. 48, no. 357, Oct. 15, 1920, pp. 815-817 and 825, 4 figs. Patented process involving use of cupola, side-blow converter and electric furnace. Details of operation and metallurgical reactions are explained. Paper read beofre Am. Foundrymen's Assn.

MARINE ENGINES

See Desel Engines, Marine.

METAL INDUSTRY

German. The Metal Supply Problem in German—I. C. A. Heise. Iron Age, vol. 106, no. 20, Nov. 11, 1920, pp. 1295-1297. How war shortage were met by substitutions. Effect of latter on present and future consumption of copper and tin.

METALLURGY

Developments in. Recent Progress in the Control of Metallurgical Products (Les progrés récents des méthodes de contrôle des produits métallurgiques), Léon Guillet. Génie Civil, vol. 77, no. 16, Oct. 16, 1920, pp. 313-316, 7 figs. Industrial uses of equilibrium diagrams of alloys (Concluded).

METALS

Crystal Growth. Crystal Growth and Recrystallisation in Metals, H. C. H. Carpenter and Miss C. F. Elam. Eng., vol. 110, no. 2858, Oct. 8, 1920, pp. 486-490, 16 figs. Review of theories of crystal growth in light of evidence obtained in experimental research. (Concluded.) (Abstract.) Paper read before Inst. of Metal.

Rust Prevention. Preventing Rust at High Temperatures, Robert June. Sci. Am., vol. 123, no. 16, Oct. 16, 1920, pp. 404 and 412-413, 4 figs. Aluminum-coated metals that will go to melting point without formation of scale.

METRIC SYSTEM

Arguments Against Adoption in U. S. Anti-Metric Resolutions. Am. Mach., vol. 53, no. 20, Nov. 11, 1920, pp. 916-917. Resolutions against compulsory adoption of metric system in U. S., passed by Automotive Wood Wheel Manufacturers' Assn., Hickory Products Assn., New Jersey Lumbermen's Assn., Kentucky Manufacturers' Assn., Am. Assn. of Engrs., Hydraulic Soc., Compressed Air Soc. and many other associations and Chambers of Commerce.

The Metric System and International Trade, Harry Alcock. Nature (Lond.), vol. 106, no. 2658, Oct. 7, 1920, pp. 169-170. Comment on Report on Compulsory Adoption of the Metric System in the United Kingdom, submitted by metric committee appointed by Conjoint Board of British Scientific Societies Recommendations include plea for continued use of British units by Department of State.

The English and the Metric Measuring System—A Comparison, C. C. Stutz. Am. Mach., vol. 53, no. 20, Nov. 11, 1920, pp. 911-913. It is held that metric units are either too large or too small for every day requireents in industry.

MILLING

Circular Segments. Milling Fixture for Circular Segments. Machy. (N.Y.), vol. 27, no. 3, Nov. 1920, pp. 229-230, 3 figs. Features of construction of hinged milling fixtures designed for use in performing gang milling operations in circular segments.

Continuous vs. Station. Continuous versus Station Milling. Machy. (Lond.), vol. 17, no. 422, Oct. 28, 1920, pp. 106-108, 4 figs. Comparison of results that are obtained by both methods of milling on identical work when using similar machines in interchangeable manufacture.

MILLING CUTTERS

Manufacture Making. "Curvex" Milling Cutters. Machy. (N.Y.), vol. 27, no. 3, Nov. 1920, pp. 250-258, 17 figs. Methods and equipment employed by Pratt & Whitney Co., Hartford, Conn., in manufacture of formed milling cutters with helical flutes.

MINE TIMBERING

Prevervative Treatment. Saving Mine Timbers from Decay. Forest Products Laboratory, Technical Notes, Oct. 15, 1920, no. 110, 1 p. Three preservatives have been found suitable for mine work: coal-tar creosote, zinc chloride and sodium fluoride.

MOLDING MACHINES

European Types. European Equipment Progressive, H. Cole Estep. Foundry, vol. 48, no. 357, Oct. 15, 1920, pp. 818-825, 21 figs. Most of molding-machine manufacturers of Europe are found in Great Britain, France, and Germany. Although war exerted depressing effect upon new molding machines, it served to develop to high efficiency those already in service. Excellence is shown in smaller types. Paper read before Am. Foundrymen's Assn.

MOTOR PLOWS

British. Fowler Ploughing Machinery. Eng., vol. 110, no. 2859, Oct. 15, 1920, pp. 507-508 and 510, 3 figs. Machines built by John Fowler & Co., Ltd. Double steam engine set rated at 8 hp. nominal is used.

Internal Combustion Cable Ploughing Engine. Eng., vol. 100, no. 2859, Oct. 15, 1920, pp. 506-507, 9 figs. Weight is 4¼ tons for each engine with fuel and spuds, and power developed is 32 b.hp. Four-cylinder Dorman engine arranged to burn paraffin is used.

MOTOR TRUCKS

British. 7½-Ton Six-Wheel Commercial Vehicles. Eng., vol. 110, no. 2859, Oct. 15, 1920, pp. 518-520, 5 figs. Engine is of four-cylinder type and develops 47 b.hp. at 1000 r.p.m. It drives through Ferodo-lined cone clutch with aluminium male member.

Olympia Show. Exhibits at the Commercial Motor Exhibition. Eng., vol. 110, no. 2860, Oct. 22, 1920, pp. 535-536 and 542, 6 figs. Leading features of exhibit at Olympia.

The Commercial Motor Exhibition. Eng., vol. 110, no. 2860, Oct. 22, 1920, pp. 546-549. Editorial comments on progress as shown by exhibits at Olympia show.

Worm Drives. Tests on Rear-Axle Worm Deives for Trucks, Kalman Heindhofer. Mech. Eng., vol. 42, no. 11, Nov. 1920, pp. 613-615, 10 figs. Determination of efficiencies under load variations. Efficiency curves showing results with four sets of gears in mesh are included. Effect of oil temperature in worm thrust bearing, on efficiency of drive is given, high efficiencies being derived at higher oil temperatures.

MOTORSHIPS

European Built. Motorship Building in Europe. Marine Eng., vol. 25, no. 11, Nov. 1920, pp. 921-923, 3 figs. Particulars of six new 14,000-ton motor vessels,

Standardization. Standardization of Motor Ships. Times Eng. Supp., vol. 16. no. 552, Oct. 1920, p. 304. Growth of policy.

N

NOZZLES

Calibration. Calibration of Nozzles for Measurement of Air Flowing into a Vacuum, Wm. L. De Baufre. Mech. Eng., vol. 42, no. 11, Nov. 1920, pp. 607-609 and p. 650, 6 figs.

O

OIL

Crude. Experimental Determination of Evaporation Losses from Crude Oil during Piping and Storage on Oil Leases, A. R. Elliott. Reports of investigations, Bur. of Mines, Dept. of Interior, serial no. 2169, Oct. 1920, 3 pp. Tests made to determine quantities and values lost.

OIL ENGINES

British. Some Lincolnshire Oil-Engines, F. H. Livens. Jl. Instn. Mech. Engrs., no. 6, Oct. 1920, pp. 673-697 and (discussion) pp. 697-707, 18 figs. Survey of most important methods of vaporization and ignition adopted and of increasing economy effected from time to time.

Velocity of Fuel Injection. Determination of the Velocity of Solid Fuel Injection, David Turcott Gas Engine, vol. 22, no. 11, Nov. 1920, pp. 318-319. Experimental study. Velocity of injection in two-stroke cycle 30 hp. oil engines varied from 103 to 109 ft. per sec. with load from 0 to 100 per cent.

See also Heavy-Oil Engines.

OIL FUEL

Economics. Fuel Oil as a Means to Increased Capacity, C. C. Lance. Ry. Mech. Engr., vol. 94, no. 11, Nov. 1920. pp. 723-724. Critical boiler plant condition relieved and efficiency improved by use of fuel oil in place of coal.

Measurement Policy. A National Liquid Fuel Policy, R. S. McBride. Power, vol. 52, no. 17, Oct. 26, 1920, pp. 565-669, 2 figs. Possibilities of producing substitutes in liquid fuel supply. Best method for distributing available supplies among various classes of users when total demand exceeds available supplies.

OIL SHALES

Commercial Retorting. Commercial Retorting of Oil Shales, Louis Simpson. Chem. & Metallurgical Eng., vol. 23, no. 16, Oct. 20, 1920, pp. 789-791. Applicability of methods used in Scotland to American oil shales.

OIL WELLS

Shutting Off Water. Shutting Off Water in Oil Wells. Petroleum World, vol. 17, no. 242, Nov. 1920, pp. 448-450, 2 figs. Patented process for shutting off water in oil wells by freezing limited area surrounding well casing.

ORES

Classifier. The Mitchell Electric Vibrating Screen, Chas. W. Stimpson. Monthly Jl. Utah Soc. Engrs., vol. 6, no. 4, Sept. 1920, pp. 51-51, 10 figs., partly on 2 supp. plates. Moving force in electric vibrator unit, applied from beneath screen cloth.

OVENS

Core Baking. Core Baking in Electrically Heated Ovens, James L. Jones. Metal Industry (N.Y.), vol. 18, no. 10, Oct. 1920, pp. 450-451, 2 figs. New electric core oven developed by Westinghouse Electric & Mfg. Co. Records of its operation. Paper read before Am. Foundrymen's Assn.

OXY-ACETYLENE CUTTING

Cast Iron. Cutting Cast Iron with the Oxy-Acetylene Flame, Alfred S. Kinsey. Acetylene Jl., vol. 22, no. 5, Nov. 1920, pp. 264-269 and p. 272, 4 figs. Method of procedure. Paper read before Am. Foundryman's Assn.

OXY-ACETYLENE WELDING

Trade School for. An Acetylene Welding and Cutting Institute. Sheet Metal Worker, vol. 11, no. 11, Oct. 29, 1920, pp. 307-310, 4 figs. School established and conducted by equipment manufacturer where sheet metal mechanics and others are given instruction in these branches of industry.

See also Autogenous Welding.

OXYGEN

Production in Germany. Oxygen and Nitrogen Production in Germany, R. Linde. Eng. Progress, vol. 1, no. 10, Oct. 1920, pp. 297-300, 5 figs. Low temperature processes. Modern installations for production of nitrogen and oxygen. Largest installations of world. Practical use of oxygen and nitrogen.

P

PAINTING

Spray. The Vortex Painter. Commercial America, vol. 17, no. 5, Nov. 1920, p. 51. Nozzle has two openings, a central opening for paint and an annular opening around center from which air is discharged as veritable blast under pressure approximating 60 lb. per sq. in.

PATTERNS

Wheels. Wheel Patterns. Machy. (Lond.), vol. 17, no. 421, Oct. 21, 1920, pp. 91-93, 7 figs. Making of patterns for webbed and flanged wheels as well as for wheels with arms. Methods used for molding wheels without complete patterns.

PETROLEUM

Production. Liquid Fuels—Wanted: A National Policy, R. S. McBride. Eng. and Min. Jl., vol. 110, no. 17, Oct. 23, 1920, pp. 283-285, 1 fig. It is urged that consideration be given to need for securing maximum oil production, reduction of consumption, or finding of new sources, to obtaining of substitutes and to adequate distribution of available supplies.

See also Oil, Crude.

PIPE, CONCRETE

Joint for. New Type of Concrete Pipe Joint, Eng. Wrold, vol. 17, no. 5, Nov. 1920, pp. 360-361. Use of machined casting for bell and spigot rings.

PLATINUM

Colombia, S. A. Platinum in Colombia, J. Ovalle. Eng. & Min. Jl., vol. 110, no. 19, Nov. 6, 1920, pp. 907-908. Foreign capital to realize future possibilities of industry. Output of Choco region increasing. That of Urals passed its peak before war. Ordinary methods of production employed.

PNEUMATIC MAIL TUBES

See Compressed Air, Pneumatic Mail Despatch.

POLES

Preservative Treatment. Preservative Treatment of Wood Poles, R. V. Achatz. Purdue University, Publications Eng. Dept., vol. 4, no. 2, June 1920, 54 pp., 18 figs. Practices in Indiana. Specifications for preservatives adopted by Am. Ry. Eng. Assn., Nat. Elec. Light Assn. and U. S. Shipping Board Emergency Fleet Corporation.

PORTS

Antwerp. The Port of Antwerp, H. E. Cooper Newham and Cliffrod Atkinson. Shipping, vol. 12, no. 4, Oct. 25, 1920, pp. 19-27 and 32, 6 figs. Cargo handling machinery and equipment.

Layout of. What the Government is Doing to Help Port Layout, F. T. Chambers. Eng. News-Rec., vol. 85, no. 18, Oct. 28, 1920, pp. 850-851. Shipping act instructs U. S. Shipping Board and Secretary of War to promote port development and transportation facilities in connection therewith. Extent to which this instruction has been carried out is outlined in article. (Abstract.) Paper read before Am. Assn. of Port Authorities.

POWER PLANTS

Automatic Regulation. Automatic Hydraulically Operated Regulating System. Iron Age, vol. 106, no. 19, Nov. 4, 1920, pp. 1185-1187, 4 figs. Area system for automatic regulation of steam, gas, moisture, temperature, electric current, etc., in use in various industries in Sweden, and being introduced in U. S. by American Galco, Inc., New York City.

POWER TRANSMISSION

Carey Oil System. The Carey Oil Transmission System. Engr., vol. 130, no. 3377, Sept. 17, 1920, p. 284, 2 figs. Machines for transmitting power by means of oil under pressure. Two pumps are used which have balls instead of disks as pistons. Balls are giving reciprocating motion in regard to cylinders by being rotated within eccentric rings.

PRESSWORK

Methods. Press Work in an Electric Motor Plant—I, Fred R. Daniels. Machy. (N. Y.), vol. 27, no. 3, Nov. 1920, pp. 261-269, 15 figs. Methods used in power press department of Gen. Elec. Co., Lynn, Mass.

PROSPECTING

Desert. Desert Prospecting, Leroy A. Palmer. Eng. and Min. Jl., vol. 110, no. 18, Oct. 30, 1920, pp. 850-853, 4 figs. Conditions characteristic of arid regions. Topographic features frequently deceptive. Principles to be observed in investigations of dry placers. Occurrence of water.

PUBLIC UTILITIES

Rate of Return. Utility Regulations and Rate of Return, Cecil F. Elmes. Elec. Ry. Jl., vol. 56, no. 16, Oct. 16, 1920, pp. 760-764. It is argued that dual standard of commerce regulation which affect utilities, but exempts other industries, has no justification on historical grounds or as matter of public policy. Effect on financing of utilities analyzed. (Abstract.) Paper read before Am. Elec. Ry. Assn.

PUBLIC WORKS

National Department of. The National Department of Public Works Situation. Eng. News-Rec., vol. 85, no. 18, Oct. 28, 1920, pp. 834-835. Report of M. O. Leighton to Engineering Council states that moral support is needed now to finish legislative program. Engineers' Corps will control unless civilians act, report says.

PULLEYS

Cone. Machining Come Pulleys, Ralph E. Flanders. Machy. (Lond.), vol. 17, no. 419, Oct. 7, 1920, pp. 11-12, 4 figs. Tooling equipment and methods employed in the quantity production of three and four-step cone pulleys.

PUMPING STATIONS

Gas-Engine-Driven. Gas-Engine-Driven Pumping Plant at the Tilbury Docks. Eng., vol. 110, no. 2860, Oct. 22, 1920, pp. 532-534, 5 figs. Installation for pumping out dry docks for Port of London Authority.

Pump Selection. Well Tests—The Basis for Pump Selection, George M. Shepard. Mun. & County Eng., vol. 59, no. 4, Oct. 1920, pp. 137-138, 1 fig. Diagram showing results of tests on 12-in. well, 380 ft. deep.

PUMPS, CENTRIFUGAL

Tests. Motor-Driven Pumps Develop High Efficiency. Eng. World, vol. 17, no. 5, Nov. 1920, pp. 358-360, 3 figs. Tests on centrifugal pumps direct connected to synchronous motors at McCarren pumping station, Water Department of City of St. Paul, Minn.

R

RADIO COMMUNICATION

Alexanderson's System. Transoceanic Radio Communication, E. F. W. Alexanderson. Gen. Elec. Rev., vol. 23, no. 10, Oct. 1920, pp. 794-803, 12 figs. Description of Alexanderson's system of telegraphic and telephonic radio.

The Alexanderson System for Radio Communication, Elmer E. Bucher. Gen. Elec. Rev., vol. 23, no. 10, Oct. 1920, pp. 813-939, 41 figs. Description is devoted principally to 200-kw. set.

See also Radiotelegraphy; Radiotelephony.

RADIOTELEGRAPHY

Antennae. Abstractive and Selective Properties of Radio Antenna Circuits, Edward Bennett. Jl. Am. Inst. Elec. Engrs., vol. 39, no. 11, Nov. 1920, pp. 995-1004, 7 figs. Consideration of properties of simple series antenna circuit with object of determining circuit proportions and frequencies which will make circuit most highly responsive to correspondent's signal and unresponsive to interference sources.

Signaling. A New Arc Method for Continuous Waves. Wireless Age, vol. 8, no. 2, Nov. 1920, p. 19, 3 figs. Method of signaling with arc transmitter.

RADIOTELEPHONY

Receivers. Duplex Radiophone Receiver on U.S.S., George Washington, Harold H. Beverage. Gen. Elec. Rev., vol. 23, no. 10, Oct. 1920, pp. 807-812, 5 figs.

RAILS

Creep of. Rail Creep. Ry. Engr., vol. 41, no. 489, Oct. 1920, pp. 412-413. Summary of views of prominent engineers on bodily movement of rails in longitudinal direction.

Electric Welding of. *See Electric Welding, Rails.*

Rolling of. Steel Rails from Sink-Head and Ordinary Rail Ingots, George K. Burgess. Chem & Metallurgical Eng., vol. 23, nos. 19 and 20, Nov. 10 and 17, 1920, pp. 921-925 and 969-975, 8 figs. Nov. 10: Experimental investigations of Pennsylvania Railway; Nov. 17: Sink-head ingots are shown to give much more uniform metal than common American types.

RAILWAY CONSTRUCTION

Earth Shrinkage in Fills. Density Tests of Earth Shrinkage in Railway Fills. Eng. News-Rec, vol. 85, no. 17, Oct. 21, 1920, pp. 782-783, 1 fig. Density tests of earth samples made by valuation department of Chicago. Burlington & Quincy Railroad. Density was found to vary according to depth in original excavation.

Shrinkage and Swell of Materials in Railway Fill. Eng. World, vol. 17, no. 5, Nov. 1920, pp. 362-363. Actual measurement taken of many fills. Rock swells, earth shrinks.:Carriers' report to Interstate Commerce Commission.

RAILWAY ELECTRIFICATION

Belgium. Railway Electrification in Belgium (Electrification des chemins de fer de l'état Belge), A. Tétrel. L'Electricien, vol. 51, no. 1261, Oct. 1, 1920, pp. 409-413, 1 fig. Proposed plan.

British. The Electrification of British Railways, Albert H. Bridge. Elec. Rev. (Chicago), vol. 77, no. 18, Oct. 30, 1920, pp. 685-686. Points considered and recommendations made by government committee of engineering and railway experts.

Japan. Electrifying Japan's State Railways, Ivan F. Baker. Trans-Pacific, vol. 3, no. 5, Nov. 1920, pp. 47-51, 8 figs. Account of progress made, with particular reference to recent projects involving electrifiction of over 400 miles. Also brief survey of railway electrification developments throughout the world.

RAILWAY OPERATION

Divisional Organization. Railway Operation and Maintenance under Divisional Organization, Alfred Price. Central Ry. Club, Official Proc., vol. 28, no. 3, May 1920, pp. 866-873 and (discussion) pp. 873-894, 1 fig. Scheme of organization of Canadian Pacific Railway.

Increasing Car Service. Increasing the Miles Per Car Per Day, A. G. Smart, J. Burnett, E. H. DeGroot, Jr., F. P. Roesch and A. F. Mercier. Ry. Age, vol. 69, no. 20, Nov. 12, 1920, pp. 824-828. Papers received in contest held by Railway Age on means for increasing the average miles per car per day.

Supervision. The Problems of the Supervising Officers, Samuel O. Dunn. Ry. Mech., vol. 94, no. 11, Nov. 1920, pp. 689-691. Their duties and responsibilities under private railroad management; organization of foremen.

RAILWAY SHOPS

Brass Castings for. Heavy Brass Castings for Railroad Shops. Ry. Mech. Engr., vol. 94, no. 11, Nov. 1920, pp. 725-726, 2 figs. It is said important savings are possible by operating brass foundries in conjunction with railroad shops.

Car, N. Y. C. N. Y. C. Steel Car Shop at East Buffalo. Ry. Mech., vol. 94, no. 11, Nov. 1920, pp. 701-703, 7 figs. Capacity of building is 236 cars.

Tools. Tools from a Railroad Blacksmith Shop, Fred H. Colvin. Am. Mach., vol. 53, no. 18, Oct. 28, 1920, pp. 795-797, 10 figs. Methods of punching, shering and forming metal.

RAILWAY TIES

Reinforced Concrete. Reinforced Concrete Sleepers—I. Indian Eng., vol. 68, no. 13, Sept. 25, 1920, pp. 179-182. Review of their requirements and their advantages.

Timber. Cross-Tie Forms and Rail Fastenings, with Special Reference to Treated Timbers, Hermann Von Schrenk. U S. Dept. of Agriculture, Bur. of Forestry, Bull, no. 50, 1904, 71 pp. Possibilities of using substitutes for wood for railway ties are discussed, methods of cutting timber ties are surveyed, and modifications in them are recommended. and specifications and classification of ties are suggested.

RAILWAY TRACK

Catchpoints. The Relative Utility of Catchpoints and Buffer Stops. Ry. Gaz., vol. 33, no. 16, Oct. 15, 1920, pp. 510-514, 11 figs. Results of some Great Western experiments in connection with derailing efficiency of various types of catchpoints, and utility of buffer stops as compared with soft banks.

Materials. On the Question of Special Steels (Subject III for Discussion at the Ninty Congress of the International Railway Association), Mr. Sand. Bul. Int. Ry. Asso., vol. 2, no. 9, Sept. 1920, pp. 563-570. Report on the kinds of special steel used for tracks. in particular for rails, switches, single and double crossings, expansion devices at ends of bridges and other parts of track. Data are based on experiences of railways in various countries.

Standardizing Work. Methods of Standardizing Track Work, Earl Stimson. Official Proc. St. Louis Ry. Club, vol. 25, no. 5, Sept. 23, 1920, pp. 55-67. Experience of Baltimore & Ohio Railroad.

Ties. *See Rails; Railway Ties.*

Work Records. New System of Track Work Records on St. L.-S. F. Ry. Eng. News-Rec., vol. 85, no. 20, Nov. 11, 1920, pp. 949-952, 5 figs. Foremen report time and amount of work in detail classification. Figures extended to cover operating divisions.

RAILWAYS

China and the Orient. The Railways of the Orient, Donald F. McLeod. Eng. News-Rec., vol. 85. no. 20, Nov. 11. 1920. pp. 952-955, 2 figs. Rolling stock and construction of roadbed are chiefly of European types. Locomotives and dining and freight cars are mostly of American type.

Location of Industries on Rights-of-Way. Hazards Incident to the Location of Industries on Railroad Right-of-way. Ry. Rev , vol. 67, no. 19, Nov. 6, 1920, pp. 713-715, 1 fig. Discussion of relations between railroads and industries, nature of whose operations are conducive to fire hazard, and forms of agreements that should properly exist between such contracting parties. Paper presented at recent convention of Railway Fire Prevention Association at Baltimore, Md.

REFRIGERATING PLANTS

Ammonia Charge. Behavior of Ammonia in Refrigerating Plants, John H. Ryan. Power, vol. 52, no. 16, Oct. 19, 1920, pp. 613-614, 2 figs. How to find quantity of ammonia necessary to add to charge of running plant.

Electrically Operated. Electrical Refrigeration, C. J. Carisen. Elec. Jl., vol. 17, no. 11, Nov. 1920, pp. 502-506, 7 figs. Progress in Chicago and suburbs.

Refrigerating Plant at Los Angeles Wholesale Terminal, C. W. Geiger. Power Plant Eng., vol. 24, no. 22, Nov. 15, 1920, pp. 1059-1061, 5 figs. Refrigerating machinery throughout is operated by electric motors, total of 340 hp. of electric motors operating 175 tons of refrigerating machinery.

RELAYS

Reverse-Power Type. Protective Relays-Reverse-Power Type, Victor H. Todd. Power, vol. 52, no. 18, Nov. 2, 1920, pp. 689-692, 10 figs. Conditions produced in system of parallel feeders when short-circuit occurs and types of reverse-power relays that will operate under these conditions. Both single-phase and polyphase relays are treated of.

RESEARCH

Aircraft. The Present Position of Aircraft Research and Contemplated Developments, E. L. Ellington. Flight, vol. 12, no. 44, Oct. 28, 1920, pp. 1130-1132; also in Engineering, vol. 110, nos. 2859 and 2860, Oct. 15 and 22, 1920, pp. 504-505 and 554-555. Directions in which British Air Ministry expect aircraft engines and accessories to develop, and steps they are taking to bring about developments they require. Paper read before Air Conference London, Oct. 13, 1920.

Co-ordination of. Co-ordination of Research in Works and Laboratories, H. R. Constantine. Jl. Instn. Elec. Engrs. (Supp.), vol 57, part 2, Oct. 1920, pp. 134-148 and (discussion) pp. 148-157. Scheme of co-ordination suggested.

Great Btitain. Report of Third Conference of Research Organizations. Dept. of Sci. & Indus. Research, no. 3, May 14, 1920, 33 pp. Titles of paper read at conference were: Relations of Research Associations on Existing Institutions for Research and Staffing of Research Association, Salaries and Superannuation.

Industrial. Scientific and Industrial Research Times Eng. Supp., vol. 16, no. 552, Oct. 1920, pp 301-302. Review of work done by Department of Scientific and Industrial Research during its five years of service.

Industrial, Canada. Science and Industry, J. C. Fields. Dominion of Canada, Bul. no. 5, 1918, 11 pp. Significance of industrial research. Address delivered to Toronto Board of Trade.

The Need for Industrial Research in Canada, Frank D. Adams. Dominion of Canada, bul. no. 1, 1918, 8 pp. Successful applications of research in other countries are pointed out. Lines along which research should be undertaken in Canada are indicated.

Non-Ferrous Metallurgy. The Development of Non-Ferrous Metallurgical Research, Ernest A. Smith. Metal Industry (Lond.), vol. 17, no. 17, Oct. 22, 1920, pp. 327-331. Chairman's address before Sheffield Section of Institute of Metals.

RESERVOIRS

Dams for. *See Dams, Tilting.*

RIVER TRAFFIC

Revival in U. S. The Revival of River Commerce, Particularly on the Mississippi River, Frank T. Hines. Jl. Engrs. Club. of St. Louis, vol. 5. no. 3, July-Aug.-Sept. 1920, pp. 13-20. Economics of river traffic. Importance of furthering present movement for its increase. Plea for liberarity from banks.

RIVERS

Snake River, Idaho. Distribution of Snake River Water During Greatest Drought. Eng. News-Rec., vol. 85, no. 20, Nov. 11. 1920, pp. 927-931, 7 figs. Continuous flow supercedes intermittent flashes. One man handles storage and natural flow like train dispatcher.

RIVETING

Electric Riveting Machine. A New Electric Riveting Machine (Eine neue elektrische Nieterwärmungsmaschine). Autogene Metallbearbeitung, vol. 13, no. 14, July 15, 1920, pp. 154-157, 1 fig. Details of new machine constructed by German Welding Machine Factory Becker & Co., Berlin-Schöneberg, for the heating with alternating current of iron rivets of from 6 to 40 mm., it is believed will play an important role in large boiler shops for bridge building, steam boiler construction and shipbuilding. An important advantage is said to be that it is easily manipulated and transported.

RIVETED JOINTS

Net Section, Specification for. New Specification for Net Section of Riveted Tension Members. C. R. Young. Can. Engr., vol. 39, no. 16, Oct. 14, 1920, p. 427, 2 figs. Comparison of approximate values with theoretically correct dimensions.

ROAD CONSTRUCTION

Ideal Type. What is Considered the Ideal Type of Road, Contract Rec., vol. 34, no. 44, Nov. 3, 1920, pp. 1044-1046. Based on replies to questionnaire sent out to representative engineers.

Selection of Type. Selecting a Type of Road Surface. Public Works, vol 49, no. 49, Nov. 6, 1920, pp. 430-432. Classification of surfaces suggested by Bur. of Public Roads.

ROAD MATERIALS

Testing. Report on Road Materials along the St. Lawrence River, From the Quebec Boundary Line to Cardinal, Ontario, R. H. Picher Canada Dept. of Mines, bul. no. 32, 1920, 65 pp., 7 figs. Methods of testing.

ROADS

Wisconsin and Michigan. Trend of Highway Development—A Survey. Eng. News-Rec., vol. 85, no. 20, Nov. 11, 1920, pp. 920-922. Practice in Wisconsin and Michigan.

ROADS, ASPHALT

Illinois. Two Illinois Asphaltic Pavements, John B. Hitell. Public Works, vol. 49, no. 19, Nov. 6, 1920, pp. 432-434. Asphaltic concrete highway pavement on rich concrete base and sheet asphalt pavement of unusually stiff mix.

ROADS, BRICK

Design. Design and Construction of Brick Roads in Reno County, Kansas, M. W. Watson. Mun. & County Eng., vol. 59, no. 4, Oct. 1920, pp. 119-121, 6 figs. Base is 3½ in. thick on sides and 5½ in. thick at center. 3-in. vertical fiber brick is used as wearing course.

ROADS, CONCRETE

Mixing Plants. Development of Local Materials Aids Road Contractor. Eng. News-Rec., vol. 85, no. 18, Oct. 28, 1920, pp. 831-833, 5 figs. Nine-bag batch mixer and other equipment used by Quilan & Robertson, Inc., New York City, in construction section or reinforced-concrete pavement in Pennsylvania.

Record Output for Central Concrete Mixing Plant. Public Works, vol. 49, no. 19, Nov. 6, 1920, pp. 434-436, 4 figs. How central mixing plant permitted laying 355 cu. yd. of seven-inch concrete pavement in a day, later increasing this to 425 with maximum haul of 3¼ miles.

ROADS, MACADAM

Tar Macadam. Tar Macadam Roads Show Lowest Total Annual Cost. Eng. News-Rec., vol. 85, no. 17, Oct. 21, 1920, pp. 783-784. Detailed cost figures on 14 highways covering six types.

ROLLING MILLS

Automobile Sheet. New Mill to Roll Automobile Sheets. Iron Age, vol. 106, no. 19, Nov. 4, 1920, pp. 1181-1185, 7 figs. Plant of Newton Steel Co., Newton Falls, Ohio. Sheets from 14 to 28 in. gage, in widths up to 48 in. and lengths up to 136 in are manufactured.

Bureau of Rolling Mill Research. Design of Experimental Rolling Mill—V, W. B. Skinkle. Blast Furnace & Steel Plant, vol. 8, no. 11, Nov. 1920, pp. 614-616, 2 figs. Details of design of experimental mill of Bureau of Rolling Mill Research.

S

SCHOOLS

Industrial. Linking Education with Factory Profits, T. P. Hickey. Factory, vol. 25, no. 9, Nov. 1, 1920, pp. 1394-1396, 2 figs. Ford Motor Co. trade schools for boys.

SCIENTIFIC MANAGEMENT

See Industrial Management.

SCREW MACHINES

Automatic. Galco Machines for the Automatic Manufacture of Screws (Machines Galco pour la fabrication automatique des vis). Revue générale de l'Electricité, vol. 8, no. 14, Oct. 2, 1920, pp. 455-457, 5 figs. Machines of Swedish manufacture.

SEARCHLIGHTS

Color of Light. Color and Spectral Composition of Certain High-Intensity Searchlight Arcs, Irwan G. Priest, W. F. Meggers, K. S. Gibson, E. P. T. Tyndall and H. J. McNicholas. Technologic Papers, Bur. of Standards, no. 168, Aug. 12, 1920, 14 pp., 8 figs. Investigations made with co-operation of Searchlight Investigation Section, Corps of Engineers, U. S. Army. It was calculated that color of light from these arcs is approximately equivalent to light of noon sun at Washington, although relatively more intense in blue-violet.

SEWAGE DISPOSAL

Irrigation Plant. Experimental Sewage Irrigation Plant in Florida F. E. Staebner. Eng. News-Rec., vol. 85, no. 18, Oct. 28, 1920 pp. 848-849, 3 figs. Filter effluent pumped to field. Discharge of risers on pipe laterals controlled by automatic float valves.

South Africa. Sewage Disposal in South Africa, Alfred E. Snape. Surveyor, vol. 58, no. 1502, Oct. 29, 1920, pp. 289-291. Comparison with practice in Great Britain.

SEWAGE PUMPING

Centrifugal Pump. Sewage Pumping Plants for Chicago Suburban Districts, Langdon Pearse. Eng News-Rec, vol 85, no. 19, Nov 4, 1920, pp 872-876, 6 figs Electric centrifugal pumps with Diesel engine stand-by service. Large sluice gates and automatic rack cleaner

SHAFTS

Strength of. Strength of Shafts and Beams, John S Watts. Am. Mach. vol 53, no. 20, Nov 11 1920, pp 909-910, 3 figs. Chart showing strengths of shafts considered as beams

SHIP DESIGN

Centre of Buoyancy. General Formulæ for the Vertical Position of the Centre of Buoyancy, L. Pistner Marine Eng, vol. 25, no. 11, Nov. 1920, pp. 908-909, 2 figs. Application of formulæ to extreme cases to be met with in practice.

SHIP PROPULSION

Diesel-Engine. Diesel Engines in Merchant Ships (motori diesel sulle navi mercantil) Luigi Monetti. Revista Marittima, vol. 53, nos. 7 and 8, July-Aug. 1920, pp. 91-100, 5 figs. Advantages of Diesel-engine propulsion for ships.

Diesel-Engine-Electric. Diesel and Diesel-Electric Drive for Freighters, Carl Commentz. Motorship, vol. 5, no. 11, Nov. 1920, pp. 1007-1009, 1 fig. Questions of weight and propeller efficiency compared with steam drive from shipbuilder's point of view.

Diesel-Engine vs. Steam Engine. The Present Position of the Marine Diesel-Engine, James Richardson. Position Eng. & Indus. Management, vol. 4, no. 18, Oct. 28, 1920, pp. 554-557. Comparison of running costs of Diesel-engined ships and steamships.

Electric. *See Ship Propulsion, Electric*

Self-Propulsion Experiments. Self-Propulsion Experiments Shipbuilding and Shipping Rec., vol. 16, no. 15, Oct. 7, 1920, pp. 429-430, 2 figs. Deducted curves of e.hp. for single and quadruple screw vessels.

SHIP PROPULSION, ELECTRIC

Cargo Vessels. Electric Drive Applied to Cargo Vessels. Power, vol. 52, no. 18, Nov. 2, 1920, pp. 706-708, 5 figs. Details of electric drive in the Eclipse, the first merchant vessel thus fitted in United States.

SHIPBUILDING

Economies. Shipbuilding Economies, G. A. Bisset Marine Eng., vol. 25, no. 11, Nov. 1920, pp. 871-879 and p. 907, 22 figs. Methods employed at Puget Sound Navy Yard for reducing cost of ship construction.

United Kingdom. Lloyd's Register Shipbuilding Returns. Shipbuilding & Shipping Rec., vol. 16, no. 17, Oct. 21, 1920, pp. 485-486. Figures for quarter ended Sept. 30, 1920.

SHIPS

Cargo. 6,300-Ton Deadweight Freighter. Marine Eng., vol. 25, no 11, Nov. 1920. pp. 885-890, 6 figs. Economical type of cargo steamer designed by Baltimore Dry Docks and Ship Building Company. Dimensions: Length overall, 356 ft.; beam, molded, 49 ft.; depth molded, 28 ft. 7½ in.; total deadweighth, 7300 tons; i.hp., 2000.

Fabricated. The Future of the Fabricated Ship. Eng., vol. 110, no. 2858, Oct. 8, 1920, pp. 464-469, 12 figs. Data relating to fabricated ships constructed in U. S.

Heeling. Heeling Ships, I. C. Hanscom. Marine Eng., vol. 25, no. 11, Nov. 1920, pp. 904-907, 6 figs. Heeling apparatus.

SHIPS, CONCRETE

Construction. Notes on Concrete Ship Construction, I. B. McDaniel. Tech. Eng. News, vol. 1, no. 7, Nov. 1920, pp. 2-3, 4 figs. Method used at San Francisco Shipbuilding Co. in construction of two 7500-ton tankers built for U. S. Shipping Board.

SILVER METALLURGY

Recovery from Manganese-Silver Ores. Recovery of Silver from Manganese-Silver Ores, Jay A. Carpenter. Eng. & Min. Jl., vol. 110, no. 19, Nov. 6, 1920, pp. 898-902. Chloridizing roasting followed by cyaniding offers considerable promise on material which cannot be treated by less costly processes. Volatilization and recovery by Cottrell process also being developed.

SNOW REMOVAL

Tests. Snow Removal Tests. Public Works, vol. 49, no. 19, Nov. 6, 1920, pp. 427-429, 2 figs. Experimental tests of New York City Street Cleaning Department.

SPARK PLUGS

Sparking Potential. The Sparking Potential of Spark Plugs. Automotive Industries, vol. 43, no. 18, Oct. 28, 1920, pp. 864-865, 1 fig. Tests made by engine sub-committee of British National Advisory Committee for Aeronautics.

SPRINGS

Spiral. Spiral Springs, P. H. Parr. Mech. World, vol. 68, no. 1762, Oct. 8, 1920, pp. 256-257. Formulæ and tables for designing them.

STANDARDS

German N. D. I. Report. Report of the German Industry Committee on Standards, (Mitteilungen des Normenausschusses der Deutschen Industries). Betrieb. vol. 2, no. 15, Aug. 1920, pp. 373-389, 24 figs. Proposals of the Board of Directors for allowances of standard holes and shafts: machining accuracy of limit gages; cylindrical and conical boring bushes; and disk keys. Proposed standards for determination of hardness according to Brinell's method; set screws and counterborings of splines; and machine-tool handles.

The Standardization of Bores, Wheel Widths and Rounding of Teeth on Change Gears (Normung der Bohrungen, Radbreiten und seitlichen Rundungen an Wechselrädern), H. Toussaint. Betrieb, vol. 2, no. 16, Sept. 1920, pp. 410-411, 2 figs. Report of the working committee for pinions.

Report of the German Industry Committee on Standards (Mitteilungen des Normenausschusses der Deutschen Industrie), Betrib, vol. 2, no. 16, Sept. 1920, pp 401-409, 12 figs. Proposals of Board of Directors for snap gages and soft steel pipes for gases and liquids. Proposed new standards for binding screws and for wrench openings.

Hollow Brick. Hollow Brick Standards (Normen für Hohlziegel), L. Schmelzer. Zeigelwelt, vol. 51, no. 29, July 24, 1920, pp. 325-327, 1 fig. Write rrefers to his own and K. Dummler's recommendations for standards.

STANDPIPES

Concrete. Concrete Standpipe for 110 ft. Head at Kansas City, T. D. Samuel, Jr. Eng. News-Rec., vol. 85, no. 18, Oct. 28, 1920, pp. 841-843, 5 figs. With 40 ft. diameter has capacity of 1,000,000 gallons. Top is 134 ft. above ground. Has joint at base.

STEAM ENGINES

Uniflow. The Uniflow Steam-Engine, F. B. Perry. Jl. Inst. Mech. Engrs., no. 6, Oct. 1920, pp. 731-743 and (discussion) pp. 743-764, 20 figs. History, principle of work and details of construction.

STEEL

Arc-Fused. Metallography of Arc-Fused Steel, Henry S. Rawdon, Edward C. Groesbeck and Louis Jordan. Chem. & Metallurgical Eng., vol. 23, no. 16, Oct. 20, 1920, pp. 777-782, 38 figs. Various lines of investigations are utilized to support idea that microscopic "plates" existing in fusion welds are due to nitrogen; that plates are very persistent, and are not responsible for low ductility of metallic piece.

Bars, Specifications. Specifications for Steel Bars for Other Uses than the Manufacture of Machine Tools (Cahier des charges pour la fourniture de barres en acier au carbone autres que les aciers à outils). Revue de Métallurgie, vol. 17, no. 8, Aug. 1920, pp. 555-560. Adopted by Commission permanente de Standardisation.

Copper, Developments in. A Review of the Development of Copper Steel, D. M. Buck. Iron Age. vol 106, no. 18, Oct. 28, 1920, pp. 1109-1110. Bibliography of subject. Use of product in steel freight cars. (Abstract.) Paper read before Am. Iron & Steel Inst.

Elastic Strength. Relative Elastic Strengths of Steel. Can. Engr., vol. 39, no. 18, Oct. 28, 1920, pp. 465-468, 1 fig. Relation of elastic strengths in shear, tension and compression. Guest's law is claimed to be erroneous, and it is held that establishment of correct ratios improves design of structural elements subject to combined stresses.

Electric. Electric Steels, C. G. Carlisle. Eng., vol. 110, no. 2857, Oct. 1, 1920, pp. 456-457. Diagram showing relation of cutting speed to durability. (Abstract.) Paper read before Iron & Steel Inst.

Impurities, Detection of. An Electrometric Method for Detecting Segregation of Dissolved Impurities in Steel, E. G. Mahin and R. E. Brewer. Jl. Indus. & Eng. Chem., vol. 12, no. 11, Nov. 1920, pp. 1095-1098, 3 figs.

Inclusions. Inclusions and Ferrite Crystallization in Steel. II—Solubility of Inclusions, E. G. Mahin and E. H. Hartwig. Jl. Indus. & Eng. Chem , vol. 12, no. 11, Nov. 1920, pp. 1090-1095, 3 figs.

Notched-Bar Tests. Experimental Study on Impact Tests of Notched Bars (Étude expérimentale sur les essais au choc des barreaux entaillés), André Cornu-Thénard. Revue de Métallurgie, vol. 17, no. 8, Aug. 1920, pp. 536-554, 5 figs. Comparative study of machines and processes. (To be continued.)

Open-Hearth, Basic. High Manganese Iron in Basic Open-Hearth Practice, E. A. Wheaton. Iron Age, vol. 106, no. 18, Oct. 28, 1920, pp. 1112-1114. Paper read before Am. Iron & Steel Inst.

Manganese Iron as Desulphurizer, E. A. Wheaton. Iron Trade Rev., vol. 67, no. 18, Oct. 28, 1920, pp. 1196-1198. Tests indicate that use of high manganese pig iron enables open-hearth operators to maintain low sulphur content in basic steel. Practice does not reduce tonnage. (Abstract.) Paper read before Am. Iron & Steel Inst.

Making Basic Open-Hearth Steel, F. L. Toy. Iron Age Rev., vol. 67, nos. 18 and 19, Oct. 28, and Nov. 4, 1920, pp. 1199-1201 and 1275-1277 and (discussion) pp. 1277-1278. Oct. 28: Developments in device and methods for preserving and lengthening life of furnace. Merits of various fuels for melting charges. Efficiency of furnaces; Nov. 4: Working high-sulphur pig iron by use of heavy lime burdens results in an excessive slag volume. Importance of manganese in controlling fluidity and basicity of slag. Pouring temperature discussed. Paper read before Am. Iron & Steel Inst. (Abstract.)

The Basic Open-Hearth Process, F. L. Toy. Iron Age, vol. 106, nos. 18 and 19, Oct. 28 and Nov. 4, 1920, pp. 1116-1119 and 1193-1195. Paper read before Am. Iron & Steel Inst.

Use of High Manganese Iron in Basic Open Hearth Practice, E. A. Wheaton. Blast Furnace & Steel Plant, vol. 8, no. 11, Nov. 1920, pp. 596-598. Paper read before Am. Iron & Steel Inst.

Production in Electric Furnace. Producing Acid Steel Electrically, James W. Galvin and Charles N. Ring. Iron Trade Rev., vol. 67, no. 17, Oct. 21, 1920, pp. 1130-1132. It is held furnace bottoms should be cup instead of saucer shaped. Effect of melting efficiency of degrees of compactness of scrap charged into furnace is studied.

See also Alloy Steel; Steel, High-Speed; Nickel Steel.

STEEL CASTINGS

Heat Treatment. Heat Treatment Improves Castings, Fred Grotts. Foundry, vol. 48, no. 21, Nov. 1, 1920, pp. 859-860 and 881, 14 figs. Strength and elongation of cast-steel tractor parts are improved by quench-and-draw treatment. Danger from hardening cracks eliminated by removing casings from water before entirely cool. Paper read before Am. Foundrymen's Assn.

STEEL, HEAT TREATMENT OF

Automobile Steels. The Heat Treatment of Automobile Steels, R. R. Abbott. Iron Age, vol. 106, no. 18, Oct. 28, 1920, pp. 1110-1112, 2 figs. Also Iron Trade Rev., vol. 67, no. 18, Oct. 28, 1920, pp. 1202-1203, 2 figs. Calculation of critical temperatures. Classification of automobile steels. Paper read before Am. Iron & Steel Inst.

Dendritic Formation. Dendritic Steel, H G. Carter. Trans. Am. Soc. for Steel Treating, vol. 1, no. 1, Oct. 1920, pp. 56-61, 10 figs. It is concluded from results obtained in experiments and microscopic examinations of bars that dendritic steel cannot be broken up structurally, and. therefore, stripping a casting while very hot gives rise to dendritic, while if casting is allowed to cool slowly dendrites will be broken up. Hot stripping is condemned as very bad practice.

Electric-Furnace. Heat Treating Steel Electrically, E. F. Collins. Foundry, vol. 48, no. 357, Oct. 15, 1920, pp. 826-830, 12 figs. Test data showing heat uniformity of electric furnace. Paper read before Am. Foundrymen's Assn.

Gas-Fired Furnaces. Hardening Steel in Gas-Fired Furnaces, W. A. Ehlers. Sci. Am., vol. 124, no. 18, Oct. 30, 1920, pp. 450 and 460, 3 figs. Details of furnaces.

Gas vs. Fuel Oil. Producer Gas for Heat Treating, Geo. H. Trout. Trans. Am. Soc. for Steel Treating, vol. 1, no. 1, Oct. 1920, pp. 51-55. Results of comparative tests using fuel oil and gas.

STEEL INDUSTRY

Europe. European Iron and Steel in 1920, H. Cole Estep. Iron Trade Rev., vol. 67, no. 18, Oct. 28, 1920, pp. 1204-1210, 8 figs. Two years after war England and continental countries with exception of Germany and Russia are regaining pre-war capacity. (Abstract.) Paper read before Am. Iron & Steel Inst.

India. India's Steel Industry Expanding, Charles P. Perin. Iron Trade Rev., vol. 67, no. 19, Nov. 4, 1920, pp 1273-1274. Extension and improvements to blast furnaces and mills will guarantee output of pig iron and steel greater than domestic needs. Country may soon place products in markets of world. (Abstract.) Paper read before Am. Iron & Steel Inst.

South Africa. South African Iron and Steel. Eng., vol. 110, no. 2858, Oct. 8, 1920, pp. 478-480. Posibilities of establishing large iron and steel industry.

Status of. Must Help to Stabilize Business, Elbert H. Gary. Iron Trade Rev., vol. 67, no. 18, Oct 28, 1920, pp. 1192-1193 Optimistic outlook is made of future developments in steel industry. Tendency, writer says, is towards lower, more reasonable and fairer relative basis. (Abstract.) Presidential address before Am. Iron & Steel Inst.

STEEL MANUFACTURE

Deoxidizers. New Deoxidizers for Steel Manufacture, J. R. Cain. Chem. & Metallurgical Eng., vol. 23. no. 18, Nov. 3. 1920, pp. 879-882. Report of co-operative investigation sponsored by National Research Council on function and action of deoxidizers, together with experimental work to find low-melting mixtures of scavenging oxides.

See also Electric Furnaces, Operating Data; Steel Refining; United Kingdom; Iron Metallurgy, Direct Process.

STEEL WORKS

Africa. Steel Plants of Africa. Iron Age, vol. 106, no. 20, Nov. 11, 1920, p. 1270. Report on present condition of industry and estimate of requirements.

British. Baldwins, Ltd., Adds New Plant, Joseph Horton. Iron Trade Rev., vol. 67, no. 17, Oct. 21, 1920, pp. 1133-1138. 20 figs. Self contained unit being completed in South Wales district by British steel syndicate. Patent company, capitalized at $35,000,000 controls works in England, Wales and Canada.

Schneider Works, France. The Iron, Steel, and Engineering Works of Messrs. Schneider and Co. Engr. (Supp.), vol. 130, no. 3377, Sept. 17, 1920, 16 pp., 22 figs Description of chief works of company in France, particularly works at Creusot and Breuil.

Sheet Mills. Material Handling Equipment is Important Factor in New Sheet Mill, E. L. Shaner. Iron Trade Rev., vol. 67 no. 19, Nov. 4, 1920, pp. 1266-1270, 9 figs. Automatic charging machines for sheet and annealing furnaces, crane equipment and electric tractor and trailer system, at works of Newton Steel Co.

STREET RAILWAYS

Cars, Safety. One-Man Safety Car Meeting Approval on Many Canadian Systems. Elec. News, vol. 29, no. 21, Nov 1, 1920, pp. 41-46, 5 figs. Thirteen towns and cities are operating them wholly or in part. It is said that platform expenses have reduced, accidents are almost unknown, schedule is maintained, and service is satisfactory.

Kansas City, Mo. Rerouting Plan to Save $620.000. Elec. Ry. Jl., vol. 56, no. 19, Nov. 6, 1920, pp. 957-961, 6 figs. Report of consulting engineer on Kansas City railways.

Pavement and Construction. Why Street Railways Should Bear Share of Pavement Cost. Eng. News-Rec., vol. 85, no. 17, Oct. 21, 1920, pp. 795-796. Brief data from 166 cities gives reasons why two-foot strip outside rails should not be diminished.

Regenerative vs. Pneumatic Braking. Street Railway Braking (Beitrag zur Frage der Strassenbahnbremsen), W. Pforr. Elektrische Kraftbetriebe u Bahnen, vol 18, no 12, Apr 24, 1920, pp. 105-108 Refers to articles appearing in preceding volume of same journal on the relative merits of the purely electric brake and the pneumatic brake with regard to efficiency, safety and economy; and presents table giving operating data of the Buenos Aires (Argentine) street railway during the years 1911-1918, collected and compiled by author, demonstrating the satisfactory use of the short-circuit brake

Zone Fares. How the Zone Fare Has Made Good at San Diego. Elec. Ry. Jl., vol 56, no 20, Nov. 13, 1920, pp 1009-1012, 5 figs In spite of low density of population, high mileage of track, large number of private automobiles and decrease in military and naval population, company shows 40 per cent more revenue and 12 per cent more passengers for first nine months of 1920 as against same period of 1919.

SUBMARINE WARFARE

Detection of Submarines. Modern Marine Problems in War and Peace, C. V. Drysdale. Eng., vol. 110, nos. 2858, 2859 and 2860, Oct. 8, 15 and 22, 1920, pp. 484-486, 6 figs., 521-523, 9 figs., and 552-554, 4 figs. Eleventh Kelvin lecture delivered before Instn. Elec. Engrs.

SUBWAYS

New York City. Rapid Transit Plan for New York Proposes 830 miles of New Track. Eng. News-Rec., vol. 85, no. 16, Oct. 14, 1920, pp. 751-757, 1 fig. Report of chief engineer of Transit Construction Committee. Twenty-one subadeolis tunnels and three moving platforms are recommended.

Stations. A Study of Rapid Transit Stations Design, Olof A. Nilsson. Eng. News-Rec., vol 85, nos. 18 and 19, Oct. 28 and Nov 4, 1920. pp 824-829, 12 figs., and 894-899, 11 figs. Possibilities for great time saving in platform arrangement. Nov. 4: Good and bad features in arrangement of platforms and street approaches. Dimensions and capacities that have been found satisfactory.

T

Square and Acme Thread. The Design of Square and Acme Thread Taps of Steep Lead, E. A. Dixie. Am. Mach., vol. 53, no. 20, Nov. 11, 1920, pp. 887-888, 7 figs. Methods of manufacture.

TAR

Removal from Coke Gas. Removing Tar from Coke Gas—V, A. Thau. Iron Trade-Rev, vol. 67, no. 20, Nov. 11, 1920, pp. 1331-1335, 10 figs. Rotary tar extractors.

TELEPHONY

Automatic. Automatic Telephone Progress. Elecn., vol. 85, no. 2214, Oct. 22, 1920, pp. 466-471, 8 figs. Introduction of panel automatic system into City of London.

London System. The Telephone Service of Large Cities, with Special Reference to London, E. A. Laidlaw and W. H. Grinsted. Jl. Instn. Elec. Engrs. (Supp.), vol. 57, part 2, Oct. 1920, pp. 158-188 and (discussion) pp. 188-201, 14 figs. Proposal is made for introduction of "unit of telephone service" as basis of charge made to subscriber. Duration of conversation determines charge.

TELESTEREOGRAPHY

Belin System. Sending Photographs Over Wires, Austin C. Lescarboura. Sci. Am., vol. 123, no. 19, Nov. 6, 1920, pp. 474—483—484, 3 figs. Belin system for sending actual photographs over ordinary telegraph wire. Photograph is received on sensitized cylinder. Quivering ray of light, originated by electric current from transmitter, operates at receiving end successively upon all parts of a sensitized paper cylinder, intensity of light varying so as to reproduce photograph.

TERMINALS, MARINE

Portland, Ore. Port Terminal Pier Design at Portland, Ore., G. B. Hegardt. Eng. News-Rec., vol. 85, no. 17, Oct. 21, 1920, pp. 796-797, 1 fig. Considerations which led to adoption of wide piers and handling machinery in new municipal docks.

TESTING MACHINES

Transverse Tests on Cast Iron. Develops New Machine for Bending Tests. Iron Trade Rev., vol. 67, no. 17, Oct. 21, 1920, pp. 1139-1140, 1 fig. Hand-operated transverse and bend testing machine actuated by oil pressure. Developed by Alfred J. Amsler & Co., Switzerland.

THERMOCOUPLES

Junctions. The Construction of Thermo-Couples by Electro-Deposition, Wm. Hamilton Wilson and Miss T. D. Epps. Physical Soc. of London, Proc., vol. 32, part 5, Aug. 15, 1920, pp. 326-340, 15 figs. Method devised to overcome difficulty of making satisfactory soldered joints between elements of thermopiles having large number of closely packed junctions, consists in using continuous wire of one of elements and coating those parts of it which have to form other element with electrolytic deposit of another metal.

TIDAL POWER

Utilization. Utilization of the Tides (Utilisation des marées) Amiral Amet. Revue générale de l'Électricité, vol. 8, nos. 14 and 15, Oct. 2 and 9, 1920, pp. 445-455, and 483-492, 15 figs. General theory. Co-ordination of available data. (To be continued.)

TOOLS

Steel, High-Speed. High-Speed Cast Steel Tools from the Electric Furnace, Sterling H. Bunnell Iron Age, vol 106, no 20, Nov 11, 1920, pp 1258-1259, 3 figs Practice of United States High-Speed Steel & Tool Corporation in making tools ready for use in any desired shape.

TOWN PLANNING

France. Reconstruction Progress and City Planning in France, George R. Ford. Eng. & Contracting, vol. 54, no. 17, Oct 27, 1920, pp. 421-422 Compulsory city planning law in France Paper read before Am Soc. for Mun. Improvements.

TRACTORS

Castings. Heat Treating Tractor Castings, Fred Grotts Iron Trade Rev, vol. 67, no. 20, Nov 11, 1920, pp 1316-1318, 12 figs. Research work conducted by Holt Mfg. Co, Peoria, Ill (Abstract.) Paper read before Am. Foundrymen's Assn.

Manufacture. Operations in Building Tractors, Fred H Colvin Am. Mach., vol. 53, no. 20, Nov. 11, 1920, pp. 877-883, 25 figs. Methods at Works of C. L. Best Gas Traction Co., California.

Tests. Tractors Perform Effectively in British Trials, M. W. Bourdon. Automotive Industries, vol. 43, no. 18, Oct 28, 1920, pp 856-860, 16 figs. Account of 1920 British tractor trials. There were 46 entries all except two of which were powdered by internal combustion engines.

TRAIN CONTROL

Automatic. Test of Shadle Automatic Train Control. Ry. Signal Engr., vol. 13, no. 10, Oct. 1920, pp. 401-405, 1 fig. Chart showing signal indications for each run as train approaches.

Intermittent-Contact Type. The Bourdette-Brookins Train Control System. Ry. Signal Engr., vol. 13, no. 10, Oct. 1920, pp. 411-413, 7 figs. System is of intermittent electrical contact type.

TRAIN LIGHTING

Lamps for. Essentials of Train Lighting. Bul. Eng. Dept. Nat. Lamp Works, Gen. Elec. Co., bul. no. 10D, Oct. 27, 1919, 16 pp., 13 figs. Suggestions as to proper use of Mazda lamps for train lighting. Technical data of lamps.

TRANSPORTATION

Land vs. Water Routes. Comparison of Cargo Transportation by Land and Water Routes, William T. Donnelly. Marine Eng., vol. 25, no. 11, Nov. 1920, pp. 899-903, 5 figs. System for prompt dispatch of cargoes by inland water routes. Fleets of separately propelled vessels travel together in convoy with central electric generating station afloat connected to fleet by cable and with all propellers driven by electric motors. Such a system is found to be more economical than any of land systems.

Steam Vehicles. Road Transportation by Steam-Vehicles, P. W. Robson. Jl. Instn. Mech. Engrs., no. 6, Oct. 1920, pp. 639-661 and (discussion) pp. 661-672, 9 figs. Sees steam motor wagon "as the most economical and reliable form of road transport."

TUBES

Manufacture. Manufacturing Steel and Iron Tubes, H. C. Ebright. Blast Furnace & Steel Plant, vol. 8, no. 11, Nov. 1920, pp. 609-612, 3 figs. Youngstown sheet and Tube Company's method of manufacturing pipe processes used in forming and welding steel tubes. Process of threading, testing and finishing.

Narrow, Riveting. Riveting of Narrow Tubes. Eng. and Indus. Management, vol. 4, no. 15, Oct. 7, 1920, pp. 456-457, 18 figs. Method of riveting narrow tubes from inside. Translated from Luftfahrt, and circulated by British Air Ministry.

TUNNELS

Construction Methods. Tunnels—XXVI. Ry. Engr., vol. 41, no. 489, Oct. 1920, pp. 426-430, 11 figs. Construction methods adopted in Rogers Pass Tunnel made by Canadian Pacific Railway in 1913-1915 in British Columbia, and at Twin Peaks tunnel, provided for new highway near San Francisco, Cal.

TURBO-GENERATORS

Steel Foundations for. Steel Foundations for 30,000-Kilowatt Horizontal Turbo-Generators, J. R. James, Power, vol. 52, no. 17, Oct. 26, 1920, pp. 646-649, 3 figs. Steel foundations for 30,000-kw. turbo-generators recently installed by Detroit Edison Co. Reduction in weight of about 500 tons was effected, difference in cost was negligible and operation has shown almost no perceptible vibration.

TURPENTINE

Data on. Turpentine: Its Sources, Properties, Uses, Transportation, and Marketing, with Recommended Specifications, F. P. Veitch and V. E. Grotlisch. U. S. Dept. Agriculture, bul. no. 898, Nov. 8, 1920, 51 pp., 7 figs.

V

VACUUM TUBES

See Electron Tubes.

VENTILATION

Ventilators. Recent Tests on Automatic Ventilators, A. J. Mack. Heat and Vent. Mag., vol. 17, no. 10, Oct. 1920, pp. 27-29, 3 figs. Results of tests indicated that siphoning ventilators have advantage over non-siphoning types.

See also Heating and Ventilation.

VOLTAGE REGULATION

Step Induction Regulator. The Step Induction Regulator, E. E. Lehr. Elec. Jl. vol. 17, no. 11, Nov. 1920, pp. 510-514, 4 figs. Structural details of apparatus and method of connecting it.

VULCANIZATION

New Process. The New Process for the Vulcanization of Rubber, S. J. Peachy. India Rubber Jl., vol. 60, no. 17, Oct. 23, 1920, pp. 25-26. Cold cure process. It consists in exposing rubber, alone or in admixture with practically any useful filling agent or pigment, successively to action of two gases, sulphur dioxide and hydrogen sulphide. Gases diffuse into rubber and there interacting produce active form of sulphur which is capable of combining with and vulcanizing rubber at ordinary temperature.

W

WAGES

Minimum. Food Requirements and the Minimum Wage. Nature (Lond.), vol. 106, no. 2661, Oct. 28, 1920, pp. 284-286. Based on figures compiled by Food Committee of Royal Society.

WALLS

Concrete. A New System of Hollow Concrete Wall Construction, Charles Alma Byers. Building Age, vol. 42, no. 11, Nov. 1920, pp. 31-32, 3 figs. System designed and patented by Charles B. Harp, construction engineer of Los Angeles, California. Walls are erected with pre-cast concrete slabs which are set edgewise in two tiers to form continuous air space.

WATER GAS

Automatic Controller. Ensuring a Constant Quality of Water Gas. Gas World, vol. 73, no. 1891, Oct. 16, 1920, pp. 297-298, 1 fig. Automatic controller manufactured by Davison and Partner, London, England.

WATER METERS

Design. Defects in Current Meters and a New Design, Samuel Fortier and E. J. Hoff. Eng. News-Rec., vol. 85, no. 20, Nov. 11, 1920, pp. 923-924, 2 figs. Meter developed to meet requirements of relatively low velocities and small channels.

WATER POWER

Federal Power Commission. Commission Drafts Its Rules. Bul. Water Power League of America, vol. 1, no. 2, Aug. 1920, pp. 9-14. Rules and regulations which will govern work of Federal Power Commission created under Federal Water Power Act.

Resources in U. S. Development of National Water-Power Resources, C. D. Wagoner. Elec. Rev. (Chicago), vol. 77, no. 19, Nov. 6, 1920, pp. 717-720, 3 figs. Analysis of developed and undeveloped water powers in U.S.

United States. Potential Water Powers. Bul. Water Power League of America, vol. 1, no. 1, July, 1920, pp. 5-6 and 24. Total possible water developments on the 4325 miles of river channels included in present navigation projects over which Federal Government retains jurisdiction for navigation purposes, are estimated to amount to at least 10,200,000 hp.

WATER SUPPLY

Cleveland. Planning the Future of the Cleveland Water Supply, A. V. Ruggles. Eng. News-Rec., vol. 85, no. 19, Nov. 4, 1920, pp. 886-889, 4 figs. Methods followed lead to $30,000,000 program by 1920 delivering 430,000,000 gallons daily from four intakes of which two will be new.

WAVES

Wave-Motion Turbine. Wave-Motion Turbine, Arthur Palme. Power, vol. 52, no. 18, Nov. 2, 1920, pp. 700-701, 4 figs. Scheme for utilization of wave motion, in operation for some time at Royan, France.

WELDING

See Autogenous Welding; Electric Welding; Electric Welding, Arc; Electric Welding, Resistance; Oxy-Acetylene Welding.

WELDS

Tests. Testing Steel Plate Welds. Iron Age, vol. 106, no. 20, Nov. 11, 1920, p. 1265. Methods for quickly determining general character of work. (Abstract.) Paper read before Am. Welding Soc.

Testing Welds, S. W. Miller. Acetylene Jl., vol. 22, no. 5, Nov. 1920, pp. 258-263 and p. 295, 26 figs. Also Welding Engr., vol. 5, no. 10, Oct. 1920, pp. 26-36, 26 figs. Methods of testing. Paper read before Am. Welding Soc.

WIND TUNNELS

Germany. Report on German Wind Tunnels and Apparatus, Edward P. Warner. Aerial Age, vol. 12, no. 10, Nov. 15, 1920, pp. 275-277, 2 figs. Description of wind tunnels at Göttingen, Aachen, Dessau and Friedrischafen together with methods of operation and details of apparatus used. (To be continued.) Report of Nat. Advisory Committee for Aeronautics.

Resistance Equation. Air Forces on Circular Cylinders, Axes Normal to the Wind, with Special Reference to Dynamical Similarity, Hugh L. Dryden. Sci. Papers, Bur. of Standards, no. 394, Sept. 4, 1920, pp. 489-519, 10 figs. Experimental study of general wind tunnel resistance equation.

WIRING

Earthing. Earthing. Jl. Instn. Elec. Engrs., vol. 58, no. 292, June 1920, pp. 468-475 and (discussion) pp. 476-490, 4 figs. Report of earthing sub-committee of Wiring Rules Committee, appointed to "consider the whole question of earthing, including the time element of circuit-breakers, the heating of conductors, the current-carrying capacity of the apparatus earthed, the drop of pressure in metal sheating, and the number of earth wires required."

WOMEN WORKERS

Management of Women. The New Place of Women in Industry—II, Ida M. Tarbell. Indus. Management, vol. 60, no. 5, Nov. 1920, pp. 329-330. Discusses successful utilization of women workers.

WOOD PRESERVATION

Charring. Charring Does not Preserve Wood. Forest Products Laboratory, Technical Notes, Oct. 15, 1920, no. 108, 1 p. Tests showed that charring deep enough to resist decay would undoubtedly weaken post of ordinary size.

Preservative Treatment. Water Solubility a Necessary Property of Wood Preservatives. Forest Products Laboratory, Technical Notes, Oct. 15, 1920, no. 114, 1 p. That any substance to be effective wood preservative must be soluble in water at least to extent of producing toxic water solution is basis of theory now being developed at U. S. Forest Products Laboratory.

WORKMEN'S COMPENSATION

U. S. and Canadian Laws. Comparison of Workmen's Compensation Laws of the United States and Canada up to January 1, 1920, Carl Hookstadt. U. S. Dept. of Labor, Bur. of Labor Statistics, no. 275, Sept. 1920, 140 pp. Covers all laws enacted up to January 1, 1920.

Engineering Index

This Index is prepared by the American Society of Mechanical Engineers.

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A

ACCIDENTS

Building Construction. Keeping Track of Construction Accidents. Contract Rec., vol. 34, no. 45, Nov. 10, 1920, pp. 1078-1081. Describes systematic method of checking safety. Report adopted by Construction Section of Nat. Safety Council.

AERIAL PHOTOGRAPHY

Surveying. Surveying from the Air, E. Lester Jones. Eng. News-Rec., vol. 85, no. 25, Dec. 16, 1920, pp. 1184-1186, 3 figs. Tests of United States Coast and Geodetic Survey.

AERONAUTICAL INSTRUMENTS

Inclinometers. Airplane Flight Instruments, Kurt Bennewitz. Aviation, vol. 9, no. 11, Nov. 29, 1920, pp. 346-348, 8 figs. Inclinometers with stationary system of references, and with moving system of reference. Translated from Technische Berichte.

AEROPLANE ENGINES

American. Modern Aviation Engines—VI, K. H. Condit. Am. Mach., vol. 53, no. 23, Dec. 2, 1920, pp. 1042-1044, 6 figs. Representative American designs for commercial aviation.

Carburetors. *See Carburetors.*

Italian. Modern Aviation Engines—V, K. H. Condit. Am. Mach., vol. 53, no. 21, Nov. 18, 1920, pp. 936-938, 5 figs. Italian types.

Pressure Gages. Pressure Gages for Airplanes. Aviation, vol. 9, no. 11, Nov. 29, 1920, pp. 357-8, 2 figs. Instructions for installing gages.

Starters. Comparative Test of Auxiliary Starting Devices for the Liberty Engine. Air Service Information Circular, vol. 2, no. 3, Sept. 25, 1920, 7 pp., 6 figs. Object of test was to compare ease of starting of 12-cylinder Liberty engine equipped with two auxiliary starting devices designed by Engineering Division, Air Service.

Wright. New Wright Aeronautical Engine. Aviation, vol. 9, no. 13, Dec. 13, 1920, pp. 420-423, 7 figs. Latest design manufactured by Wright Aeronautical Corp'n, manufacturers of Wright-Hispano engine.

AEROPLANE PROPELLERS

Blade-Screw Theory. A Few Remarks Concerning Some Fundamentals of the Theory of Blade-Screws, George de Bothezat. Aeronautical Jl., vol. 24, no. 119, Nov. 1920, pp. 595-600, 1 fig. Generalized form of fluid resistance met in case of blade screw.

Design. Screw Propellers, M. A. S. Riach. Aeronautics, vol. 19, nos. 368, 370, 371 and 372, Nov. 4, 18, 25 and Dec. 2, 1920, pp. 327-328, 362-365, 377-378 and 401-402, 6 figs. Nov. 4: Design formulas. Nov. 18: Equations of motion. Nov. 25: Formulas for determining stresses. Dec. 2: Relation between "momentum" and "aerofoil" theories of propeller, assuming "inflow" as theory basis. (Continuation of serial.)

Variable-Pitch. The Oddy Variable Pitch and Reversing Propeller, A. M. Buckwald. Aerial Age, vol. 12, no. 11, Nov. 22, 1920, p. 299, 1 fig. Propeller exhibited at London Aero Show.

Variable-Pitch Propeller for Flying at High Altitudes (Hélices à pas variable pour le vol aux grandes altitudes), J. Stroescu et D. Cusmanovici. Aérophile, vol. 28, nos. 17-18, Sept. 1-15, 1920, pp. 272-273, 4 figs. Patented design.

AEROPLANES

Aerofoils. The Wragg Adjustable Compound Aerofoil, C. A. Wragg. Aerial Age, vol. 12, no. 13, Dec. 6, 1920, p. 346, 2 figs. Device for enabling wider speed variation. It consists of using two aerofoils suitable for every high speed and placing them at low incidence, one behind and a little below the other so that there is a small gap between them.

Balancing. A Method for Determining the Angular Setting of a Tail Plane to Give Balance at any Given Condition, L. V. Kerber and W. F. Gerhardt. Aerial Age, vol. 12, no. 14, Dec. 13, 1920, pp. 370-373, 1 fig. Method includes determination of proper angular setting of horizontal tail plane to give longitudinal balance at level flight at any given speed, climbing flight at best rate of climb and when gliding at any angle with power off.

Bischoff. The Bischoff Small Aeroplane (L'avionnette de Bischoff), R. Esnault-Pelterie. Aerophile, vol. 28, nos. 17-18, Sept. 1-15, 1920, pp. 266-268, 2 figs. Dimensions: Length, 3.52 m.; height, 1.3 m.; width, 5.2 m.; total weight, empty, 102 kgr.; speed, 90 kw. per hr.

Centering. Centering Aeroplanes (Centrage des Avions), L. Huguet. Vie Technique et Industrielle, vol. 1, no. 9, June 1920, pp. 207-210, 6 figs. Influence of various elements of aeroplane upon its longitudinal stability in flight. (Continuation of serial.)

Design. Some Requirements of Modern Aircraft. Eng., vol. 110, no. 2864, Nov. 19, 1920, pp. 683-684, 6 figs. Requirements of aeroplanes for commercial aviation service.

Giant. Post-War Types of Giant Aeroplanes (Les avions géants d'après-guerre), Jean-Abel Lefranc. Nature (Paris), no. 2430 Oct. 30, 1920, pp. 276-285, 2 figs. Survey of developments. (To be continued.)

Helicopters. *See Helicopters.*

Hydroplanes. *See Hydroplanes.*

Metallic Construction. The Utilization of Metallic Structures in Aeroplanes (L'utilisation des profilés métalliques dans la construction des aéroplanes). Aéronautique, vol. 2, no. 14, July 1920, pp. 52-54, 19 figs. Metals used, types of structures and methods of joining.

Model, Experiments with. Some Experiments with Model Airplanes, Albert A. Merrill. Aviation, vol. 9, no. 11, Nov. 29, 1920, p. 349, 2 figs. Experiments made in Eiffel's laboratory and National Physical Laboratory in England to determine static stability in pitch for models with elevator set in various positions.

Passenger. The Unusual in Passenger Carrying Airplanes, Alfred Longville. Sci. Am., vol. 123, no. 25, Dec. 18, 1920, p. 609, 3 figs. Recent developments in Germany and Italy.

Ranges. A Study in Aeroplane Ranges and Useful Loads, J. G. Coffin. Flight, vol. 12, nos. 47 and 48, Nov. 18 and 25, 1920, pp. 1199-1201, 2 figs., and 1214-1216, 3 figs. Nov. 18: Theory of maximum range conditions. Nov. 25: Effect of wind on range calculations.

Single- vs. Twin-Engined. A Comparison of Single- and Twin-Engined Aeroplanes, R. M. Hill. Aeronautics, vol. 19, no. 368, Nov. 4, 1920, pp. 320-321. Comparison from pilot's point of view. (Concluded.) Paper read before Royal Aeronautical Society

Spars. The Design of Spars with Offset Pin Joints, Harris Booth. Aeronautical Jl., vol. 24, no. 118, Oct. 1920 pp. 563-574. Stresses in bay of spar under different loads. Design formulas.

Stability. Aerodynamic Study of the Supporting Members of an Aeroplane (L'étude aérodynamique des organes sustentateurs d'avion), M. Rocca. Aéronautique, vol 2, nos. 14 and 15, July and Aug. 1920, pp. 87-91, 3 figs., and 129-132, 8 figs. Prantl method as set forth in the German press.

Tests. Static Tests of Aeroplanes (Essais statiques des avions), Paul Boccacio. Aéronautique, vol. 2, no. 17, Oct. 1920, pp. 190-195, 8 figs. Methods of procedure.

Transport. Proposed Transport Airplane. Aviation, vol. 9, no. 100, Nov. 22, 1920, p. 321, 1 fig. Dimensions: Span, 125 ft.; overall height, 19 ft.; length overall, 75 ft.; total area, 3864 sq. ft.; maximum speed, 130 m.p.h.; total weight, 18.5 tons.

Variable-Surface. A French Variable Wing. Aeronautics, vol. 19, no. 372, Dec. 2, 1920, p. 391 3 figs. Gastambide-Levavasseur design.

Another New Wing. Aerial Age, vol. 12, no 11, Nov. 22, 1920, p. 297, 2 figs Developed by Levavasseur. inventor of Antoinette monoplane.

The New Variable Surface Airplane, H. M. Buckwald. Aviation, vol. 9, no 10, Nov. 22, 1920, pp. 314-316. 6 figs. Levavasseur and Gastambide is a tractor biplane fitted with 250 hp. Salmson engine. Pilot can vary surface, while in flight, from 345 sq. ft. to 560 sq. ft., by sliding panels in the upper plane.

Wings. The New Handley Page Aeroplane Wing. Engr., vol. 130, no. 3383, Oct. 29, 1920, p. 421, 2 figs. Slotted wing form. In trial tests, slotted machines rose at sharper angle, climbed more quickly, alighted at much slower speed and pulled up in considerably shorter distance than ordinary type

Why the Wing of Uniform Section May Survive, Douglas Shaw. Aeronautics, vol. 19, no. 370, Nov. 18, 1920, p. 359. Because of its comparatively low cost of production. It is besides aerodynamically justified and desirable, and is a sound engineering compromise.

See also Variable-Surface.

AIR BRAKES

Defects. Car Failures Caused by Improper Brake Maintenance, E. H. Wood. Official Proc. Car Foreman's Assn., vol 16, no. 2, Nov. 1920, pp. 21-33 and (discussion) pp. 34-71, 7 figs. Classification and discussion of principal defects in brake apparatus that cause car failures.

AIR COMPRESSORS

Lubrication. Lubrication of Air Compressors, H. V. Conrad. Glass Industry, vol. 1, no. 2, Dec. 1920, pp. 41-43, 1 fig. Practice recommended by Compressed Air Society.

AIR-HOSE LINES

Couplers. Making Thor Quick-Action Air Line Couplers, J. V. Hunter. Am. Mach., vol. 53, no. 21, Nov. 18, 1920, pp. 931-933, 10 figs. Machining operations used in producing couplers in large quantities.

AIRCRAFT CONSTRUCTION MATERIALS

Wire Cables. Wire Cables, Walter A. Scoble. Aeronautical Jl., vol. 24, no. 118, Oct. 1920. pp. 537-562, 3 figs. Tests on wire rope under tension, shock and vibration. Bearing of core diameter on strength of cables. Cables tested were of types used in aeronautics.

AIRSHIPS

Commercial. The Commercial Airship — Its Operation and Construction, Trevor Dawson. Flying, vol. 9, no. 11, Dec. 1920, pp. 665-673, 9 figs. Traffic possibilities of airships. Size of airship required. Development of motoring power. Possibilities of reducing cost of construction and operation.

German. The German Airships L 64 and L 71. Automobile Engr., vol. 10, no. 144, Nov. 1920, pp. 445-447, 6 figs. Notes on their machinery installations.

Hangars. *See Hangars.*

Wiring of The Transverse Wiring of the Rigid Airship, E. H. Lewitt. Aeronautics, vol. 19, no. 372, Dec. 2, 1920, pp. 397-400, 6 figs. Theoretical investigation into magnitude and variation of tensions in transverse wires of rigid airship caused by pressure of adjoining gas bag.

ALCOHOL

See Automobile Fuels, Alcohol.

ALLOY STEELS

Analysis. The Analysis of Special Steels, C. O. Bannister. Elecn., vol. 85. no. 2216, Nov. 5, 1920, pp. 535-538, 5 figs. Use of electrometric titration methods.

Comparative Efficiency. A Suggested Method for Determining the Comparative Efficiency of Certain Combinations of Alloys in Steel, J. D. Cutter. Trans. Am. Soc. for Steel Treating, vol. 1, no. 3, Dec. 1920, pp. 188-190 and (discussion) pp. 190-3 198, 7 figs. Formula for merit index is given. Efficiency is defined as ratio of effect produced to energy expended.

Effect of High Temperature. Comparative Values of Motor Valve Steels, G. Gabriel. Iron Age, vol. 106, no. 23, Dec. 2, 1920, pp. 1465-1469, 1 fig. Analysis of effects of high temperature on physical properties of tungsten, chrome and nickel steels. Translated from La Technique Automobile et Aérienne.

ALLOYS

Carbon. Alloys of Carbon with Manganese, Nickel, Iron, Cobalt and Chromium. Foundry Trade Jl., vol. 22. no. 227, Nov. 1920 p. 853, 3 figs. Investigations by German Society of Engineers. Translated from Forschungsarbeiten.

Nickel-Chromium. *See Nickel-Chromium Alloys.*

ALUMINUM

Conductors. Aluminum and Its Application in Electric Transmission Lines (L'aluminium et son application aux lignes électriques), M. Dusaugey. Annales des Postes, Télégraphes et Téléphones, vol. 9, no 3, Sept. 1920, pp. 366-412, 8 figs. Electrical properties of aluminum conductors are given in comparison with similar copper conductors. It is concluded from records of service of aluminum conductors in production and transmission of power that they are equally as good as copper conductors from a technical standpoint and are economically superior.

Uses. Aluminum and Its Alloys. W. Rosenhain. Jl. Royal Soc. Arts, vol. 68, nos. 3546 and 3548, Nov. 5 and 19, 1920. pp. 791-798, 8 figs., and 819-827, 2 figs. Brief outline of manufacture of aluminum, followed by consideration of its physical and chemical properties.

ALUMINUM ALLOYS

Magnesium. The Constitution of the Alloys of Aluminum and Magnesium, D. Hanson and Marie L. V. Gayler. Metal Industry (Lond.), vol. 17, no. 20, Nov. 12, 1920, pp. 383-387, 2 figs. Experiments at Metallurgy Department of National Physical Laboratory, England.

AMMONIA

Sulphate, Manufacture of. Manufacture of Sulphate of Ammonia, Alec. George Cheal and E. V. Evans. Gas Jl., vol. 152, no. 3003. Dec. 1, 1920, pp 515-517 and (discussion) pp. 517-523, 3 figs. Direct process of sulphate of ammonia manufactured. Methods of utilizing and drying sulphate. Papers read before Southern District Assn. Gas Engrs. & Managers, England.

APPRENTICES, TRAINING OF

Prussian-Hessian State Railways. The Training of Fitter-Apprentices in the Workshops of the Prussian-Hessian State Railways, W. J. Horne. So. African Jl. of Sci., vol. 16, no. 5, April-July 1920, pp. 411-425. List of practical exercises at training workshops for apprentices.

Systems. Programs of Apprenticeship and Special Training in Representative Corporations—V, J. V. L. Morris. Am. Mach., vol. 53, no. 21, Nov. 18, 1920, pp. 951-952, 4 figs. System of training machinists used in plant of Sperry Gyroscope Co., Brooklyn, N.Y.

Programs of Apprenticeship and Special Training in Representative Corporations, J. V. L. Morris. Am. Mach., vol. 53, no. 24, Dec. 9, 1920, pp. 1078-1080, 5 figs. Apprenticeship system of De La Vergne Machine Co., New York.

AUTOMOBILE ENGINES

Air Cooling. The Position of Air-Cooling, B. H. Davies. Autocar, vol. 45, no. 1310, Nov. 27, 1920, pp. 1055-1058, 12 figs. Review of present situation and possible lines of development.

British Designs. Tendencies in British Engine Design Noted at Olympia, M. W Bourdon. Automotive Industries, vol. 43, no. 22, Nov. 25, 1920, pp. 1060-1065 and 1067, 18 figs. Most notable type observed by writer was carefully designed, small-powered car. (To be continued.)

Hot-Spot Comparative Tests with a Hot-Spot Device, Roy E. Berg. Automobile Industries, vol. 43, no. 24. Dec. 9, 1920, pp. 1170-1173, 5 figs. Dynamometer tests made in engine laboratory of Lewis Institute showed appreciable fuel economy over wide range speed, smoother low speed, throttle operation and reduced crankcase dilution with Losee hot-spot device fitted to six-cylinder engine.

Properly Applied Heat — An Answer to the Fuel Question, Roy E. Berg. Motor Age, vol. 38, no. 20, Nov. 11, 1920, pp. 7-10, 9 figs. Tests on six-cylinder engine fitted without and then with hot-spot of replacement type.

Radiators. Automotive Radiators, Karl F. Walker. Jl. Soc. Automotive Engrs., vol. 7, no. 6, Dec. 1920, pp. 549-553, 6 figs. Curves showing relation between core depth and heat-dissipating capacity, and effect of water flow on heat-dissipating capacity.

AUTOMOBILE FUELS

Alcohol. A New Motor Spitir, C. F. Juritz. So. African Jl. of Industries, vol. 3, no. 10, Oct. 1920, pp. 889-894. Introduction of new solvent.

Benzol-Alcohol Mixtures. Benzol-Alcohol Experiments on Omnibuses, G. J. Shave. Eng., vol. 110, no. 2862, Nov. 5, 1920, pp. 623-624. Fuel experiments carried out by London General Omnibus Co. Paper read before Imperial Transport Council, London.

Gasoline. *See Gasoline.*

Mixtures. Fuel Mixtures on London Omnibuses, G. J. Shave. Jl. Soc. Automotive Engrs., vol. 7, no. 6, Dec. 1920, pp. 556-557.

Petroleum. Use of Petroleum in Automobile Engines. (Petroleumbetrieb), H. Praetorius. Motorwagen, vol. 23, no. 25, Sept. 10, 1920, pp. 465-472, 11 figs. Account of examination, by the Technical Commission of Automobile Club of France in collaboration with Gen. Automobile Assn. and Syndical Chamber of Petroleum Industries, of the Aldo, the Genault and the Bellem & Brégéras carburetors; and details of the Egtal pump, with which test was made using mixture of 40 per cent benzine and 60 per cent petroleum in engine of 4-cylinder automobile of latest construction with 80 mm. bore and 130 mm. stroke, and with 1800 revolutions an output of 30 hp. was achieved with fuel consumption of 270 gr. per hp-hr.

AUTOMOBILES

Differential Casings. Machining Worm-driven Differential Casings. Eng. Production, vol. 1, no. 13, Dec. 1920, pp. 477-482, 17 figs. Description of methods employed.

Front-Axle Swivels. Front-Axle Swivels. Automobile Engr., vol. 10, no. 145, Dec. 1920, pp. 478-479, 5 figs. Justification of vertical steering pivots.

Gear Ratio vs. Car Economy. Effect of Gear Ratio on Car Economy, J. N. Golten and Allan Neumann. Automotive Industries, vol. 43, no. 24. Dec. 9, 1920, pp. 1167-1169, 8 figs. Methods of obtaining best car performance with respect to fuel economy when using various gear ratios. Graphs and experimental date.

Locking Gear. The Goodheart Differential. Motor Traction, vol. 31, no. 818. Nov. 1, 1920, pp. 513-514, 4 figs. Automatic locking gear which eliminates wheel spinning.

Olympia Show. The Automobile Show Automobile Engr., vol. 10, no. 145, Dec. 1920, pp 486-489, 14 figs Trend of design as shown by exhibits in International Exhibition at Olympia and White City

Transmission Case. Franklin Transmission Case, Fred. H. Colvin. Am. Mach., vol. 53, no. 22, Nov. 25, 1920, pp. 1001-1004, 10 figs. Machining operations.

AVIATION

Aerial Routes. Climatological Factors Governing the Selection of Air Routes and Flying Fields, C. LeRoy Meisinger. Aerial Age, vol 12 no. 11, Dec 13, 1920, pp. 368-369 and 373. Importance of meteorological studies in connection with the establishment of aerial routes and layouts of flying fields.

Canadian Air Board Report. Report of Canadian Air Board. Aviation, vol. 9, no. 8, Nov. 8, 1920, p. 264. Among matters considered are recent flight operations, Associate Air Research Committee; air navigation instructions for Commercial fliers, and application of air regulations to civilians.

Civil. Civil Aviation. Aeronautical Jl., vol. 24, no. 119, Nov. 1920, pp. 579-590 and (discussion) pp. 590-594. Growth and present position of air mail, passenger and goods service, specially in United Kingdom and British Dominions and Colonies. Factors contributing to successful air services, and suggestions for their successful future development.

Civil Aviation and Air Services, F. H. Sykes. Flying, vol. 9, no. 11, Dec. 1920, pp. 674-679, 2 figs. Growth and present position of air mail, passenger and goods services. Factors contributing to successful air services.

The Organization of Civil Aviation Along International Lines, William Knight. Aerial Age, vol. 12, no. 13, Dec. 6, 1920, pp 344-345. Urges creation of powerful organization that will establish and operate aerial lines of communication between most important centres of the world, and will take initiative in framing up legislation needed for governing navigation of air.

Commercial, German. Commercial Aviation in Germany. Aeronautics, vol. 19, no. 371, Nov. 25, 1920, pp. 375-376, 1 fig. Recent developments. Map of air routes established. (To be concluded.)

Course Determination. Route Correction — A New Method of Aerial Navigation (Correcteur de route; nouvelle méthode de navigation aérienne à l'estime), M. Le Prieur. Comptes rendus des Séances de l'Académie des Sciences, vol. 171, no. 16, Oct. 18, 1920, pp. 700-702. Aerial navigation by means of "derivograph," air apparatus which determines direction to be followed, corrected for wind, in order to reach a given place by straight line flight.

Hazards. Effective Study of Aviation Hazards Begun. Automotive Industries, vol. 43, no. 21, Nov. 18, 1920, pp. 1026-1027. Preliminary reports by Committee on Aviation Hazards of National Safety Council.

Mail Service. The Air Postman, H. S. Holt. Aeronautics, vol. 19. no. 370, Nov. 18, 1920, p. 360. Equipment required at terminal points. Organization of mail service.

Night Flying. Night Flying, Cecil Baker. Aeronautics, vol. 19, no. 368, Nov. 4, 1920, pp. 323-325. Experience during war. Problems of low flying finding way, and landing.

Spins. Spins. Flight, vol. 12, no. 47, Nov. 18, 1920, pp. 1192-1195, 6 figs. How to describe a spin. Precautions to take Stresses in aeroplane. Paper read before Cambridge University Aeronautical Society.

Switzerland. Aerial Navigation in Switzerland (La navigation aérienne en Suisse), E. H. Lémonon. Aérophile, vol. 28, nos. 17-18, Sept. 1-15, 1920, pp. 274-277, 2 figs. Development of aviation in Switzerland.

See also Flight.

AXLES

Heat-Treating. Plant for Heat Treating Automobile Axles, L. M. Thomas. Am. Drop Forger, vol. 6, no. 11, Nov. 1920. pp. 533-536, 3 figs. Plant of Timken-Detroit Axle Co. Automatic annealing furnaces are used.

B

BALANCING

Slow-Speed vs. High-Speed. Slow-Speed vs. High-Speed Balancing, N. W. Akimoff. Am. Mach., vol. 53, no. 21, Nov. 18, 1920 pp. 925-926, 1 fig Balancing at low speeds is considered sufficiently conclusive, because if machine element cannot be balanced at such speeds, perfect balance will not be established at any speeds.

BEAMS

Continuous. Calculations for Continuous Beams with Third-Point Loading, Ewart S. Andrews. Concrete and Constructional Eng., vol. 15, no. 11. Nov. 1920, pp. 732-736, 5 figs. Case in which secondary beams run into main beams at third points.

BLOWERS

Parallel Operation. The Operation of Blowers in Parallel for Forced Draft in Naval Service, M. C. Stuart and Arthur H. Sennet. Jl. Am. Soc. Naval Engrs., vol. 32, no. 4, Nov. 1920, pp. 688-718, 14 figs. Experimental investigation. It is concluded that fans operating in parallel should be run at the same speed because relatively small differences in speed cause an unequal division of load between fans in such a manner as to result in greater total shaft horsepower than would be required to reduce same draft conditions with fans running at equal speeds.

BOILER FEEDWATER

Heating. The Mathematical Theory of Boiler Feed-Water Heating in Steam Turbine-Driven Power Stations, Robert Dowson. Eng., vol. 110, nos. 2862 and 2863, Nov. 5 and 12, 1920, pp. 593-595, 4 figs., and 627-628. Nov. 5: Formula expressing total work lost by tapping off steam for feedwater heating. Nov. 12: Application of theory to design of group of surface feedwater heaters.

BOILERS

Construction Examining a Steam Boiler Plant, Chas F. Wade. Eng. & Indus Management, vol 5, no 21, Dec 2, 1920 pp 706-710, 5 figs. Methods of construction and testing boilers. (To be continued.)

Marine. *See Marine Boilers.*

Producer Gas-Fired. Producer Gas-Fired Boiler Installation in France. John H. Bartlett, Jr. Chem. and Metallurgical Eng., vol 23, no. 21, Nov 24, 1920, pp 1033-1035, 5 figs Description of installation and operation of producer gas-fired boiler plant at Montrambert, Loire, Coal Mines, using coked slack and mine waste for production of gas.

Rivet Steel. Standard Specifications for Boiler Rivet Steel. Boiler Maker, vol. 20, no 12, Dec 1920, pp. 351-355. Revised specifications of American Society for Testing Materials.

Waste-Heat. *See Furnaces, Open-Hearth, Waste-Heat Boilers.*

BRASS

Melting by Gas. Melting of Brass, A. L. Palmer. Gas Industry, vol. 20, no. 11, Nov. 1920, pp. 251-254. Phases covering application of gas to brass melting.

BRIDGES, RAILWAY

Standards. The New Canadian Steel Railway Bridge Specification. Eng and Contracting vol. 54, no. 21, Nov 24, 1920, pp. 516-518. Standards specification prepared by Canadian Engineering Standards Association's sectional committee.

BRIDGES, STEEL

Stress Measurements. Secondary Stresses in Kenova Bridge Measured, John I Parcel and George A. Maney. Eng. News-Rec., vol. 85, no. 24, Dec 9 1920, pp 1116-1119, 10 figs. Tests to determine secondaries at four joints under moving coal trains give satisfactory check with calculated results. Effect of load variation and floor stiffness.

BUILDING CONSTRUCTION

Cost Accounting. Practical Means of Estimating Equipment Cost. Contract Rec., vol. 34, no. 49, Dec. 8, 1920, pp. 1161-1163. Rental schedule prepared by Associated General Contractors of America, that aims to give adequate charges for use of contracting plant.

Costs. Building Material and Construction Costs—I, Theodore F. Laist. Am. Contractor, vol. 1, no. 22, Dec. 4, 1920, pp. 33-35. Study dealing with cost of building construction and of materials used in connection therewith. Brick is first material considered, being discussed under three heads, specifications, methods employed in quantity surveying and cost analysis.

Equipment. Rental Schedule for Estimating Construction Equipment Expense. Eng. and Contracting, vol. 54, no. 24, Dec. 15, 1920, pp. 583-584. Rental Schedule for construction equipment.

Lightning Protection. Protection Against Lightning. Contract Rec., vol. 34, no. 47, Nov. 24, 1920, pp. 1132-1133. Procedure for rodding structures, based on practice in United States and Canada.

Portals. The Stresses in Portals and Similar Structures—III. Engr., vol. 130, no. 3383. Oct. 29, 1920, pp. 417-418, 5 figs. Formulae for computing stresses.

C

CABLEWAYS

Design. Dedactic Study of Aerial Cableways (Étude didactique des transporteurs aériens sur câbles), Giulio Ceretti. Génie Civil, vol. 77, no. 21, Nov. 20, 1920, pp. 408-411, 7 figs. Characteristics of metallic cables. Notes on design. (To be continued.)

CANALS

Design. The Hydraulic Jump and Critical Depth in the Design of Hydraulic Structures, Julian Hinds. Eng News-Rec., vol. 85, no. 22, Nov. 25, 1920, pp. 1034-1040, 10 figs. How established principles may be applied to design of canals and other works. Study based on laws of conservation of energy and linear momentum.

CAR COUPLERS

Universal. The Universal Car and Hose Coupler. Railroad Herald, vol. 24, no 11, Oct. 1920, pp. 27-29. 4 figs. Features are: (1) Beveled engaging surfaces of coupler head, whereby "high and low" couplings are entirely removed; (2) locking or latch is always open and ready for use as soon as cars are uncoupled; (3) coil spring is held in groove or cavity, giving it snug fit; (4) one man can easily handle coupler shank; etc.

CARBURETORS

Automatic. Modern Automatic Carburetors for Volatile Fuels (Étude des carburateurs automatiques modernes pour carburants volatils), A. Grebel. Génie Civil, vol. 77, no. 19, Nov. 6, 1920. pp. 370-375, 15 fig. Developments in design. (To be continued.)

Induction Systems. Induction Systems, T. L. Sherman. Automobile Engr., vol. 10, no. 144, Nov. 1920, pp. 433-439, 28 figs. Comparative study of induction type of carburetors of principal aeroplane engines.

Tests. The German Carburetter Trials, J. L. Chaloner. Automobile Engr., vol. 10, no. 144, Nov. 1920, pp. 450-453. 15 figs. Account of trials carried out under control of General German Automobile Club.

CARS

Brakes. *See Air Brakes.*

CASE-HARDENING

Building for. Modern Case Hardening Building at Providence. Iron Age, vol. 106, no. 24, Dec. 9, 1920, pp. 1539-1540. Features include arrangements for maximum ventilation with minimum light and dipping and cooling tanks.

See also Crankshafts, Case-Hardening.

CAST IRON

Carbon in. On the Crystalline Nature of Graphite and Temper-Carbon Obtained from Cast Iron, Kei Iokibé. Sci. Reports of the Tôhoku Imperial University, vol. 9; no. 4, Aug. 1920, pp. 275-279, 4 figs. on supp. plate.

Sulphur in. The Sulphur Problem in Cast Iron, George K. Elliott. Foundry, vol. 49, no. 24, Dec. 15, 1920, pp. 978-979. Basic electric furnace said to produce sulphur far below 0.05 per cent. Paper read before American Foundrymen's Association.

CENTRAL STATIONS

Economics. Central-Station Costs and Income. Elec. World, vol. 76, no. 22,Nov. 27, 1920, pp. 1067-1068, 4 figs. Tendencies that appear under present conditions. Vigorous efforts are apparent to increase plant efficiency and render larger service in face of higher costs. Larger revenue helping to meet usual requirements.

South America. Power Development in New World and Asia, L. W. Alwyn-Schmidt. Power Plant Eng., vol. 24, no. 23, Dec. 1, 1920, pp. 1113-1115. Prospects for central station. Power development in South America.

COAL

Calorific Value. Economic Value of Coal—II, Calorific Value and Relative Plant Economy with Coal as Fuel, B. S. Murphy. Power, vol. 52, no. 24, Dec. 14, 1920, pp. 936-937, 1 fig. Laboratory tests of coal.

COAL HANDLING

Bucket Cars. How Coal is Handled in South Africa. Coal Age, vol. 18, no. 24, Dec. 9, 1920, pp. 1178-1179, 3 figs. Coal is loaded into ten-ton buckets which are lifted by crane on to specially fitted car. At receiving station bucket can be removed by crane.

COAL MINES

Firedamp. Firedamp Explosions, R. V. Wheeler. Iron & Coal Trades Rev., vol. 101, no. 2752,Nov. 26, 1920, pp. 715-719, 13 figs. Conditions necessary for continues propagation of flame in mixtures of firedamp and air. Characteristics of flames produced as dependent upon different conditions upon which ignition of mixture is effected. Paper read before Midland Inst. Min. Civil & Mech. Engrs., England.

Hydraulic Stowing. The Suggested Application of Hydraulic Stowing to Undersea Coal Working, with Special Reference to the Sydney Coalfield, Walter Herd. Monthly Bul. Can. Inst. Min. & Metallurgy, no. 103, Nov. 1920, pp. 835-845, 5 figs. Economic advantages of hydraulic stowing.

COAL STORAGE

Piling. Piling Storage Coal to Prevent Fire, W. D. Langtry. Power, vol. 52, no. 21, Nov. 23, 1920, pp. 815-817, 7 figs. Suggestions in regard to choosing suitable place, avoidance of breakage in unloading, segregation of different sizes, outside sources of heat and mixing of combustible matter with coal.

COKE OVENS

By-Product. Modern By-Product Oven Operation, C. R. Bellamy. Gas Age, vol. 46, no. 9, Nov. 10, 1920, pp. 340-342, 4 figs. Results obtained by ovens built at Detroit, Mich., for Ford Co.

COMBUSTION

Air Supply. Air for Combustion. Power, vol. 52, no. 24, Dec. 14, 1920, p. 952, 2 figs. Chart showing pounds of air required per boiler horsepower, boiler and furnace efficiency and per cent excess air being given.

CONCRETE

Aggregates. The Strength of Fine-Aggregate Concrete, F. E. Giesecke, H. R. Thomas and G. A. Parkinson. Univ. of Texas Bul., no. 1855, Oct. 1, 1918, 17 pp., 5 figs.

Hydrated Lime, Effect of. Effect of Hydrated Lime in Concrete, Duff A. Abrams. Contract Rec., vol. 34, no. 50, Dec. 15, 1920, pp. 1183-1186. Answers to criticisms (see Contract Record, Nov. 24, 1920) of writer's original report which was based on researches regarding effect of various admixtures in concrete. Original paper was read before American Society for Testing Materials.

Proportioning. Proportioning Concrete Aggregates When Unscreened or Pit Run Gravel is Used, L. A. Dean. Eng. & Contracting, vol. 54, no. 22, Dec. 1, 1920, p. 534, 2 figs. Graphs for determining proportions of aggregates.

Recent Developments in Concrete Mixtures, H. C. Boyden. Ry. Rev., vol. 67, no. 21, Nov. 20, 1920, pp. 778-783, 7 figs. Graphs showing relations between strength of concrete and water content, relation between fineness, modulus of aggregate and strength of concrete, diagram for determining quantity of sand required in concrete mixer, and Abram's table of proportions and quantities for one cubic yard of concrete.

Tests. Pouring and Pressure Tests of Concrete, W. A. Slater and A. T. Goldbeck. Technologic Papers of Bur. of Standards, no. 175, Oct. 11, 1920, 13 pp., 4 figs. Maximum pressure against forms during pouring of concrete was found to be equivalent to that of liquid weighing about 124 lb. per cu. ft. Maximum pressure was found to be that due to head of concrete existing at end of about 40 min. After that time pressure gradually decreased in spite of increasing head of concrete.

Ten-Year Tests Showing the Effect of Age and Curing Conditions on the Strength of Concrete, M. O. Withey. Wisconsin Engr., vol. 25, no 2, Nov. 1920, pp. 19-21, 2 figs. It is concluded that humidity of surrounding medium in which portland cement concrete is cured exercises marked effect upon its crushing strength. It was found that portland cement could be kept without deteriorating for several years when stored in tight tanks, or cylindrical galvanized-iron grain bins.

CONCRETE CONSTRUCTION

New System. A New System of Concrete Construction Making Use of Standard Wood Forms. Building Age, vol. 42, no. 12, Dec. 1920, pp. 23-25, 5 figs. Wooden permanent forms developed and patented by Samuel S. Colt.

Slabs. Diagram for Flat Slabs, O. Wolpert. Concrete, vol. 17, no. 5, Nov. 1920, pp. 142-143, 1 fig. Diagram for estimating quantity of steel and total thickness of slab required for square interior flat slabs, with drop panels, based on regulations of City of New York.

Reinforced Concrete Design Standards, C. A. P. Turner. Concrete, vol. 17, no. 5. Nov. 1920, pp. 152-155, 6 figs. Standards proposed by several associations which are criticized on basis that their reasoning is not verified by experimental evidence. It is emphasized that mathematical theory to be acceptable should be substantiated by experiment.

Reinforced Concrete Saw-Tooth Slab Design, J. W. Pearl. Concrete, vol. 17, no. 5, Nov. 1920, pp. 163-164, 2 figs. Chart for designing slabs.

Safe Loads and Deflections for "Gunite" Slabs, Can. Engr., vol. 39, no. 21, Nov. 18, 1920, pp. 525-529, 10 figs. Tests on 43 slabs at Lehigh University disclose high flexural strength, bending stress of 1800 lb. per sq. in. on 1: 2½ gunite with factor of safety of 4. Deflections were less than those for poured slabs. Reinforcement tables run up as results of experiments are included.

Subaqueous. Experiences in Subaqueous Concrete Work, Henry R. Lordly. Cornell Civil Engr., vol. 28, no. 6. March 1920, pp. 254-263, 4 figs. Successful instances of placing concrete under water are related. It is held there is no further need of building expensive cofferdams.

CONCRETE, REINFORCED

Wood Reinforcement. Reinforcing Concrete with Wood (Le béton armé de bois). Génie Civil, vol. 77, no. 20, Nov. 13, 1920, pp. 394-396, 8 figs. Methods of reinforcing developed in experiments.

CONDENSERS, STEAM

Selection. Application of Steam Condensers, F. A. Burg. Elec. Jl., vol. 17, no. 12, Dec. 1920, pp. 583-587, 6 figs. Factors bearing on selection of type of condenser.

Surface. Surface Condensers, Luther D. Lovekin. Twenty-eighth General Meeting, Soc. Naval Architects & Mar. Engrs , Nov. 11 and 12, 1920, no. 7, 5 pp., 10 figs. Progress in design of surface condensers as applied to power plants in U. S. Navy Ships.

CONVEYORS

Cable. The Rose Cable Conveyor, George Frederick Zimmer. Eng., vol. 110, no. 2864, Nov. 19, 1920, pp. 665-667, 37 figs., partly on supp. plate. Wire rope conveyor for medium distances, designed by J. Pearce Roe.

Combined Skip Hoist and Conveyor. Combined Skip-Hoist Elevator and Conveyor, George Frederick Zimmer. Eng. and Indus. Management, vol. 4, no. 19, Nov. 4, 1920, pp. 597-598, 5 figs. Device patented by Warren Travell, of Exeter Machine Works, New York City. It combines skip hoist with band conveyor and with tipping trolley on wheels.

CORE OVENS

Electrically-Heated. Core Baking in Electrically Heated Ovens, J. L. Jones, Iron Age, vol. 106, no. 22, Nov. 25, 1920, pp. 1385-1387, 3 figs. Results or comparative tests of electric and fuel heated core ovens. New Westinghouse thermostat control.

Electrifying the Foundry Core Room, J. L. Jones. Elec. World, vol. 76, no. 25, Dec. 18, 1920, pp. 1203-1204, 3 figs. Cores baked in electrically heated ovens shown to have 50 to 200 per cent greater strength than those baked in fuel-fired ovens.

CORK

Substitute for. A Substitute for Cork. Commerce Reports, no. 283, Dec. 2, 1920, p. 978. Turf treaded by special patented progress developed by chemical works at Bruenn-Koenigsfeld, Prague.

CORROSION

Iron and Steel. Experiments on the Corrosion of Iron and Steel, William D. Richardson. Can. Chem. Jl., vol. 4, no. 11, Nov. 1920, pp. 299-307. Passivity of iron as oxidation phenomenon. (Concluded.)

COST ACCOUNTING

Factory. Factory Costs. L. T. Konopak. Jl. of Accountancy, vol. 30, no. 5, Nov. 1920, pp. 329-337. Describes cost system designed for factory manufacturing transmissions, and forms provided for reporting the various transactions of factory designed to facilitate handling clerical work in a routine manner with least consumption of time.

COSTS

Relation to Selling Prices. The Determination of Costs and Their Relation to Profit and Selling Prices. Eng. & Indus. Management, vol. 4, no. 23, Dec. 2, 1920, pp. 713-715. Predetermination of prices.

CRANES

Floating. Two-Hundred Ton Mammoth Floating Crane at Gusto Shipyard, Schiedam, Holland (Grue Flottante "Mammoth," de 200 tonnes, des Chantiers Gusto, de Schiedam (Hollande) Génie Civil, vol. 77, no 19, Nov 6, 1920, pp. 365-367, 3 figs. Crane can lift 200 tons 52 m. high above surface of water. Radius of action is 31 m.

CRANKSHAFTS

Case-Hardening. Case-Hardening Process for Crankshafts Successfully Developed, Norman G. Shidle. Automotive Industries, vol. 43, no. 21, Nov. 18, 1920, pp. 1016-1019, 5 figs. Process developed from tests made by H. H. Franklin Manufacturing Co.

CUPOLAS

Charges, Determining. Method for Determining Cupola Charges. H. L. Campbell. Foundry Trade Jl., vol. 22, no. 227, Nov. 1920, pp. 856-857, 1 fig. Chart for determining mixtures.

CYLINDERS

Automobile Engines. How Cylinders are Made in England, H. Cole Estep. Foundry, vol. 48, no. 23, Dec. 1, 1920, pp. 933-939, 13 figs. Standardization of operations and extensive use of molding machines have aided quantity production.

D

DAMS

Hydraulic-Fill. Some Investigations and Studies in Hydraulic-Fill Dam Construction, J. Albert Holmes. Proc. Am. Soc. Civil Engrs., vol. 46, no. 9, Nov. 1920, p. 975. Results of studies of experiments made in connection with building of earth dams. Description of construction methods used and results obtained. (Abstract).

Masonry. The Construction of Masonry Dams (Construction des barrages en maçonnerie), Paul Levy-Salvador. Revue générale de l'Electricité, vol. 8, no. 18, Oct. 30, 1920, pp. 603-612, 4 figs. Modification in construction methods which will have to be effected by reason of new conditions brought about by the war.

DIES

Double-Flanged Shell. Dies for Double-Flanged Shell, J. Bingham. Machy. (Lond), vol. 17, no. 424, Nov. 11, 1920, pp. 176-178, 10 figs. Procedure for designing drawing dies.

DIESEL ENGINES

Busch-Sulzer. Diesel Engines in a Modern Flour Mill. Power, vol. 52, no. 21, Nov. 23, 1920, pp. 808-810, 5 figs. Busch-Sulzer and Fulton-Tosi types used.

Fuel Injection. Air-Injection or Mechanical-Injection, J. L. Chaloner. Motorship, vol. 5, no. 12, Dec. 1920, pp. 1084-1085, 8 figs. Technical study of fuel injection in Diesel engines. (To be continued.)

Some Experiments in Connection with the Injection and Combustion of Fuel Oil in Diesel Engines, C. J. Hawkes. Trans. North-East Coast Instn. Engrs. & Shipbuilders, advance paper, 44 pp., 28 figs. Experiments carried out at British Admiralty Engineering Laboratory in connection with development of high-speed engine for naval purposes. Both solid-injection and air-injection systems were taken up.

Marine. Building Diesel Marine Engines for Merchant Vessels—I, Fred B. Jacobs. Mar. Rev., vol. 60, no. 12, Dec. 1920, pp. 640-647, 12 figs. Manufacturing methods at Busch-Sulzer Bros.-Diesel Engine Co., St. Louis.

Opposed-Piston. British Admiralty Experiments with Diesel Engines—III, C. J. Hawkes. Motorship, vol. 5, no. 12, Dec. 1920, pp. 1086, 3 figs. Tests on Doxford opposed-piston submarine Diesel engine. (Concluded.)

DRILLING

Automobile Plants. Multiple Drilling in Automobile Plants. Machy. (Lond.), vol. 17, no. 426, Nov. 25, 1920, pp. 225-229, 10 figs. Multiple-spindle drilling machines.

Deep-Hole. Some Experiences in Deep-Hole Drilling, Charles J. Starr. Am. Mach., vol. 53, no. 23, Dec. 2, 1920, pp. 1023-1026, 9 figs. Requirements of Drill.

DRILLING MACHINES

Multiple-Spindle. A Multiple Spindle Drilling Machine, G. L. Bohannon. Boiler Maker, vol. 20, no. 11, Nov. 1920, pp 321-323, 5 figs. Machine built by Thomas Spacing Machine Co., Pittsburgh, Pa. Chief feature is chain drive which gives direct pull on spindles and is said to eliminate power losses.

Semi-Automatic. A New Type of Semi-Automatic Drilling Machine. Machy, (Lond.), vol. 17, no. 423, Nov. 4, 1920, pp. 139-140, 5 figs. Drill is fed to work by automatic cam motion. Feature is tilting work table whereon two work-holding fixtures may be mounted, each being brought under drill spindle in turn. Machine is manufactured by S. Ratcliffe, Ltd., Manchester, England.

DRILLS

Electric. Portable Electric Tools, Machy. (Lond.), vol. 17, no. 427, Dec. 2, 1920, pp. 250-252, 7 figs. Electric drills.

Twist. Proper Care of Twist Drills as a Means of Economy, G. P. Blackiston. Boiler Maker, vol. 20, no. 12, Dec. 1920, pp. 360-361. Tables showing speeds and feeds for carbon and high-speed drills.

DROP FORGING

Practice. Drop Forging, J. H. Moore. Can. Machy., vol. 24, no. 23, Dec. 2, 1920, pp. 485-489, 9 figs. Examples of drop-forging practice, including axles and crankshafts.

DYE HOUSES

Organization and Construction. Organization and Construction of Dye Houses, A. W Benoit. Mech Engr, vol 42, no 12, Dec 1920, pp. 673-674 and p 700, 2 figs Machinery organization location, construction, ventilation and piping of dye houses considered from engineering viewpoint

DYNAMOMETERS

Farm Tractors. National Physical Laboratory Traction Dynamometer for Agricultural Tractors, J. H Hyde. Eng., vol 110, no. 2865, Nov 26, 1920, pp. 693-694, 7 figs. Apparatus consists of cylinder and plunger, former being attached to drawbar of tractor, and latter through links to plow Pull on coupling sets up pressure in oil confined in cylinder, at flexible hydraulic tube

E

EDUCATION, INDUSTRIAL

Ford Institute of Technology. Linking Education With Factory Costs—III, T. P. Hickey. Factory, vol. 25, no. 11, Dec. 1, 1920, pp. 1726-1730, 8 figs. Organization of Ford Inst. of Technology.

ELECTRIC DISTRIBUTION

Underground Systems. Underground Electric Distribution Systems, A L. Freret. Power Plant Eng, vol. 24, no. 24, Dec. 15, 1920, pp. 1177-1179, 7 figs. Forms of construction, installation of cables and arrangements of systems employed. Paper read before Assn. Iron & Steel Elec. Engrs.

ELECTRIC DRIVE

See Ice Plants, Electrically Driven; Rolling Mills, Electrically Driven.

ELECTRIC FURNACES

Booth. Booth Rotating Electric Brass Furnace, Carl H. Booth. Iron Age. vol. 106, no. 23, Dec. 2, 1920, pp. 1463-1464, 2 figs. Records recently made on 500 lb. rotating electric furnace at plant of Enterprise Brass Works, Muskegon, Mich. Paper read before Am. Foundrymen's Assn.

Combustion vs. Electric vs. Combustion Furnaces for Low Temperatures, Frank W. Brooke and George P. Mills. Chem. and Metallurgical Eng., vol 23, Nov 24, 1920, pp. 1008-1010. Electric furnaces are found to have advantage in temperature control, reliable and permanent source of heat and maintenance. Cost of power is counterbalanced by economy in space, auxiliaries, and operation, while quality of product is greatly enhanced.

Commercial Types. The Electric Melting Furnace, Joseph W. Richards, F. W. Brooke, R. D. Thomas, S. H. Ourbacker, G. H. Clamer. Jl. Am Inst. Elec. Engrs., vol. 39, no. 12, Dec. 1920, pp. 1034-1043, 16 figs. Structural details of principal commercial types.

Linings. Linings for Electric Furnaces, R. M. Howe. Iron Trade Rev., vol. 67, no. 23, Dec. 2, 1920, pp. 1541-1543. Survey is made of nine materials used as refractories for electric units. Physical characteristics compared. Fusion points are lowered by pressure. Silica and magnesia tend to spall.

Metal Industries, Use in. The Present Status of the Electric Furnace in the American Metal Industries, Robert M. Keeney. Chem. & Metallurgical Eng., vol. 23, no. 20, Nov. 17, 1920, pp. 980-984. Present technology and future possibilities of electric furnace as applied in manufacture of synthetic cast iron, steel, steel castings, ferroalloys and in heat treating, brass melting and smelting of nonferrous ores. Paper read before Nat. Elec. Light Assn.

Refractories for. Refractories For Electric Furnaces, R. M. Rowe. Foundry, vol. 48, no. 22, Nov. 15, 1920, pp. 911-913. Survey of different materials and tables of their physical characteristics. Paper read before Elec. Furnace Assn.

Steel Manufacture. English and American Types of Electric Iron and Steel Furnaces Compared, John B. C. Kershaw. Iron & Coal Trades Rev., vol. 101, no. 2750, Nov. 12, 1920, pp. 637-640 and 655-658, 16 figs. Based on records of operation at steel works.

ELECTRIC LAMPS, MERCURY ARC

Cooper Hewitt. The Cooper Hewitt Quartz Lamp and Ultra-Violet Light, L. J. Buttolph. Gen. Elec. Rev., vol. 23, no. 11, Nov. 1920, pp. 909-916, 8 figs. Summary of latest developments of compilation of related technical data.

ELECTRIC LOCOMOTIVES

Driving Gears. Driving-Gear Arrangements in Electric Locomotives (Treibwerksanordungen bei elektrischen Lokomotiven), A. Marschall. Zeit. für Dampfkessel u. Maschinenbetrieb, vol. 43, no. 39, Sept. 24, 1920, pp. 299-302, 3 figs. Discussion of various types, including the Brown, Boveri & Cie and the Tschantz driving gear, but with special consideration of the latest Lentz construction, with which it is said to be possible to render gear ratio between motor- and driving-wheel shaft variable, as with automobile gears.

ELECTRIC SWITCHES

Design. Mathematical Analysis of the Mechanical Forces Acting on Switches and Busbars, L. B. W. Jolley. Elecn, vol. 85, no. 2220, Dec. 3, 1920, pp. 646-647, 3 figs. Forces acting on switches and busbars at periods of short circuit. (To be concluded.)

ELECTRIC TRANSMISSION LINES

Protective Relays. Protective-Relay Applications and Testing Practice, H. P. Sleeper. Elec. Rev. (Chicago), vol. 77, no. 23, Dec. 4, 1920, pp. 871-875, 9 figs. Current relays with selective time setting used on radial systems. Ring and parallel-feeder systems require directional relays. Special connections necessary for machinery protection.

Voltage Control. Voltage Control of Long-Distance Tranmission Lines, Alfred Still. Elec. Rev. (Chicago), vol. 77, no. 23, Dec. 4, 1920, pp. 876-878, 4 figs. Use of Line-drop compensators. Effect of electrostatic capacity. Voltage regulation of feeders. Influence of power-factor.

ELECTRIC WELDING

Development. Practical Applications of Electric Welding, F. P. Vaughan. Jl. Eng. Inst. Canada, vol. 3, no. 12, Dec. 1920, pp. 556-564, 5 figs. Survey of electric welding methods, resistance, carbon arc, metallic arc and quasi-arc; methods of application, tables of power consumption, etc.; training welder, protection devices.

Electropercussive. Recent Developments in Electro-Percussive Welding, Douglas F. Miner. Welding Engr., vol. 5, no. 11, Nov. 1920, pp. 27-28 and 32, 7 figs. Describes apparatus used which consists essentially of device for producing a percussive engagement of parts to be welded, practically simultaneous with discharge of electrical energy. Gives examples of electropercussive welding and photomicrographs.

ELECTRIC WELDING, ARC

Overhead. Overhead Arc Welding—Theory and Practice, O. H. Eachholz. Power, vol. 52, no. 20, Nov. 16, 1920, 776-780, 11 figs. Also results of tensile tests made on sections cut from overhead welds.

Selecting Employees. The Scientific Selection of Men, Arthur Frank Payne. Sci. Monthly, vol. 2, no. 6, Dec. 1920, pp. 544-547. Experience with mental tests in army.

ENGINEERING SOCIETIES

Relationship to Public Service. Some Phases of Relationship of Engineering Societies to Public Service, Herbert Hoover. Jl. Am. Inst. Elec. Engrs., vol. 39, no. 12, Dec. 1920, pp. 1073-1075. Address before Federated American Engineering Societies.

ENGINEERS

Civic Activities. The Engineer and the Public. Eng., vol. 110, no. 2864, Nov. 19, 1920, pp. 675-685, Urges participation by engineers in civic and national activities.

ENGINEERS

Remuneration. Manitoba Engineers Pledged to Salary Schudule. Can. Engr., vol. 59, no. 20, Nov. 11, 1920, pf. 505-508. Work being done by Remuneration Committee of Manitoba Branch, Engineering Institute of Canada, in enforcing Salary Committee's recommendations. Branch has decided that "any engineer who fails to receive salary adequate to his class as recommended by the Remuneration Committee will be assisted by the Engineering Institute of Canada to obtain other employment at adequate remuneration and will receive the moral, and, if necessary financial support of all other engineers in the province." Classification of engineers and schedule of salaries prepared by Salary Committee are included.

EXCAVATORS

Mechanical. Machinery in Public Works. Mechanical Excavators (Le machinisme dans les travaux publics. Les pelles excavatrices), L. D. Fourcault. Technique Moderne, vol. 12, no. 9, Sept. 1920, pp. 373-377, 10 figs. Conditions of application of steam excavators. Description of various types of steam excavators.

F

FACTORIES

Layout. Economy of Horizontal Space by the Machine Layout. J. Edward Schipper. Automotive Industries, vol. 43, no. 20, Nov. 11, 1920, pp. 964-967, 6 figs. Description of Holley carburetor factory. Light work is arranged on continuous table with machines spaced by requirements of workmen.

FACTORY MANAGEMENT

See Industrial Management.

FANS, CENTRIFUGAL

Design. The Design and Construction of Fans—I, F. G. Whipp. Mech. World, vol. 68, no. 1768, Nov. 19, 1920, pp. 354-355, 3 figs. Calculation of efficiencies of propeller fans.

FATIGUE

Industrial. An Experiment with Rest Pauses, J. Loveday. Eng. & Indus. Mangement, vol. 4, no. 23, Dec. 2, 1920, pp. 716-718. Experiment in British shoe factory. Double presses were worked with team of three girls each operative working 40 min. in each hour and resting 20 min. Output was increased from 57 to 75 per cent.

FILTERS, SAND

Sand Shrinkage. Surface Shrinkage of Rapid Filter Sand Bends, Weston Gavett. Eng. News-Rec., vol. 85, no. 23, Dec. 2, 1920, pp. 1081-1083, 2 figs. Explanation of sand shrinkage in rapid filter sand beds.

FLOTATION

Froth. Froth Flotation, Walter Broadbridge. Chem. Eng. and Min. Rev., vol. 12, no. 139, Apr. 5, 1920, pp. 250-252, 6 figs. Its commercial application and its influence on modern concemtration and smelting practice.

FOREMEN

Training of. Adopt Methods to Develop Foremen, M. C. Evans. Foundry, vol. 48, no. 24, Dec. 15, 1920, pp. 1001-1004. Detailed description of foreman's development course which was conducted during six months of last fall and winter at plants of International Harvester Co. Paper read before American Foundrymen's Association.

FORGING

Gas for. Gas for Forging. Gas Industry, vol. 20, no. 11, Nov. 1920, pp. 257-260. Requirements and advantages.

Why Gas Excels for Forging. Gas Rec., vol. 18, no. 9, Nov. 10, 1920, pp. 67-69. Experience of Henry L. Doherty Co.

FOUNDRIES

Air Furnace for. Air Furnace Iron for Big Castings, H. E. Diller. Foundry, vol. 48, no. 24, Dec. 15, 1920, pp. 973-977, 8 figs. Air furnace used in one of foundries of Westinghouse Electric & Mfg. Co.

Equipment. Choosing Correct Plant Equipment, Joseph J. Wilson. Foundry, vol. 48, no. 24, Dec. 15, 1920, pp. 985-988. Selection of machines and appliances exemplified in case of foundry of Saginaw Products Co., Saginaw, Mich. Paper read before National Founder's Association.

FOUNDRY EQUIPMENT

Developments. Foundry Equipment in Modern Plants, Joseph J. Wilson. Iron vol. 106, no. 22, Nov. 25, 1920, pp. 1392-1397, 10 figs. Survey of recent developments.

FUELS

Colloidal. The Case for Colloidal Fuel, Lindon W. Bates. Chem. Age (Lond.), vol. 3, no. 75, Nov. 20, 1920, pp. 558-559. Economic advantages. Paper read before Instn. Petroleum Technologists.

See also Oil Fuel; Pulverized Coal; Research, Liquid Fuels.

FURNACES

Heat Flow Through Walls. Heat Flow Through Furnace Walls—II, E. F. Davia. Trans. Am. Soc. for Steel Treating, vol. 1, no. 2, Nov. 1920, pp. 140, 17 figs. Experimental measurements.

FURNACES, ELECTRIC

See Electric Furnaces.

FURNACES, HEATING

Labor-Saving Features. Heating Furnaces and Anealing Furnaces, W. Trinks. Blast Furnace & Steel Plant, vol. 8, no. 12, Dec. 1920, pp. 671-675, 12 figs Labor saving features of different types of furnaces.

FURNACES, HEAT-TREATING

Electric Heaters. Electric Heaters for Heat Treating Furnaces—II, H. O. Swoboda. Am. Drop Forger, vol. 6, no. 11, Nov. 1920, pp. 540-543. 9 figs. Carbon and graphite resistors are used with success in several types of furnaces. Furnace charge is used as heater in special cases. Temperature control.

Oil-Burning. Annealing and Heat Treatment Furnaces, James E. Wilson. Jl. Engrs Club of Phila., vol. 37-12, no. 192, Dec. 1920, pp. 488-489. Design, regulation of cost of oil-burning steel heat-treating furnaces.

FURNACES, OPEN HEARTH

Waste-Heat Boilers. Application of Waste Heat Boilers to Open Hearth Furnaces, Thomas R. Tate. Jl. Engrs. Club of Philal, vol. 37-12, no. 192, Dec. 1920, pp. 485-487. Design of proper size and type boiler for any installation. Paper read before Assn. Iron & Steel Elec. Engrs.

G

GAGES

Indicating. Indicating and Contour Gauges. Machy. (Lond.), vol. 17, no. 427, Dec. 2, 1920, pp. 259-263, 11 figs. Classification and description.

Limit. Limit Gauges. Eng., vol. 110, no. 2863, Nov. 12, 1920, pp. 643-644. Developments in standardization.

Limit Plug. Quantity Production of Combination Limit Plug Gauges. Machy. (Lond.), vol. 17, no. 423, Nov. 4, 1920, pp. 151-153, 4 figs. Combination limit plug gage introduced by Taft-Pierce Mfg. Co., Woonsocket, R.I.

Screw-Thread. Hardening Screw Gauges with Least Distortion, Wilfrid J. Lincham. Can. Machy., vol. 24, no. 22, Nov. 25, 1920, pp. 472-476, 14 figs. Method developed at Goldsmith's College, London.

GAS ENGINES

Castings. Problems Encountered in Gas Engine Castings, Pat Dwyer. Foundry, vol. 49, no. 24, Dec. 15, 1920, pp. 980-983, 9 figs. Casting practice at plant of Rathbun-Jones Engineering Co., Toledo, Ohio.

GASOLINE

Production of. Production of Gasoline. Power, vol. 52, no. 20, Nov. 16, 1920, pp. 788-789. Statistics of refinery production of gasoline for period of sixteen years, 1904 to 1919, inclusive. Advance publication of Bureau of Mines Bulletin No. 191.

Specifications. Aviation Gasoline Specifications and Methods for Testing. Air Service information Circular, vol. 1, no. 46, Aug. 30, 1920, 8 pp. 3 figs. Specifications cover three grades of gasoline known as domestic aviation gasoline, export gasoline and fighting gasoline. Distillation test is required for determining grade of gasoline. Procedure and details of manipulation in conducting distillations are explained.

GEARS

Bevel. A New Development in Bevel Gear Cutting. Machy. (Lond.), vol. 17, no. 425, Nov. 18, 1920, pp. 199-203, 8 figs. Attachments applicable to ordinary shaping machine.

Design. Graphical Method for Designing a Set of Complex Gears (Méthode graphique par anamorphose pour l'établissement des trains d'engrenages complexes), Luc Denis. Vie Technique et Industrielle, vol. 1, no. 9, June 1920, pp. 221-222, 3 figs. Examples. (Concluded.)

Involute. Involute Teeth, Richard Gardner. Eng., vol. 110, no. 2864, Nov. 19, 1920, pp. 659-660, 2 figs. Design formulas.

Machining Blanks. Machining Friction Gear Blanks and Friction Cones, J. H. Moore. Can. Machy., vol. 24, no. 17, Oct. 21, 1920, pp. 371-373, 8 figs. Examples of work performed according to practice of Foster Machine Co., Elkhart, Ind.

Pitch-Measuring Machine. The Wickman Pitch Measuring Machine. Automobile Engr., vol. 10, no. 145, Dec. 1920, p. 481, 4 figs. Machine is designed to measure tooth spacing at pitch line as well as concentricity of pitch circle with bore.

Reduction. *See Reduction Gears.*

Spur. Backlash Standards for Spur Gears, Charles H. Logue. Am. Mach., vol. 53, no. 23, Dec. 2, 1920, pp. 1040-1041, 2 figs. Formula for determining proper backlash for spur gears, and tables computed from formula.

Welding of. The Art of Welding Gears and Pinions, F. H. Sweet. Blast Furnace & Steel Plant, vol. 8, no. 12, Dec. 1920, pp. 684-685. Advisability of welding each tooth separately or of welding several teeth en bloc. Selection of proper welding tip and filler rod.

GIRDERS

Design. Reduction of Girder and Column Live Loads, C. R. Young. Can. Engr., vol. 39, no. 23, Dec. 2, 1920, pp. 565-569, 2 figs. Principle of discounting improbable live loads generally observed intensity of floor loads for buildings varies inversely as tributary area. Review of various reduction rules. New specification suggested.

Stresses in. Notes on Impact, F. W. Gardier. Proc. Am. Soc. Civil Engrs., vol. 46, no. 9, Nov. 1920, pp. 976-977. Relation between static and dynamic stresses in girder spans for smooth rolling loads. It was found that for speeds that obtain in railroad practice dynamic effect of smooth rolling loads may be neglected: dynamics increment of stress for single load for critical speed is given as 31.8 per cent. (Abstract.)

GLUES

See Aircraft Construction Materials, Casein Glue.

H

HANDLING MATERIALS

Railway Shops. Handling Material in Railway Shops, Frank A. Stanley. Am. Mach., vol. 53, no. 21, Nov. 18, 1920, pp. 953-954, 7 figs. Typical labor-saving devices.

HARDNESS

Instruments for Testing. Rapid Measurement of Hardness and Resilience of Metals (Mesures rapides de la dureté et de la résilience des métaux), S. Boisthorel. Nature (Paris), no. 2427, Oct. 9, 1920, pp. 230-234, 10 figs. Guillery portable apparatus for use in workshops.

Measurement of. The Measurement of the Hardness of Metals, Hugh O'Neill. Mech. World, vol. 68, no. 1769, Nov. 26, 1920, pp. 383-384, 2 figs. Classification of methods. Discussion of their relative advantages and disadvantages. (To be continued). Paper read before Sheffield University Metallurgical Soc.

HEAVY-OIL ENGINES

Pistons. Piston and Rings for Heavy Oil Engines, W. D. Forbes. Mar. Eng., vol. 25, no. 12, Dec. 1920, pp. 1002-1003, and p. 1013. Solid and forged pistons discussed. Method of forming piston rings from castings. Assembling forged pistons.

HIGHWAY ENGINEERING

Course in. Sixth Annual Short Course in Highway Engineering. University Bulletin, vol. 22, no. 16, Feb. 23 to 27, 1920. 140 pp. Information in regard to purpose of course, time given, scope, instruction staff and conditions of admission. Technical papers dealing with various phases of highway engineering are included.

HOISTS

Drum Design. Calculation of Stresses in Winding-Drum Flanges. Am. Mach., vol. 53, no. 25, Dec. 16, 1920, pp. 1130-1131. 2 figs. Diagrams of forces acting. Rational Design of Hoisting Drums, Everett O. Waters. Mech. Eng., vol. 42, no. 12, Dec. 1920 pp. 675-679, 9 figs. Theoretical formula is deduced for total pressure against drum flange caused by winding-on of rope to given depth and under given initial tension. Two other formulas are also deduced, which relate total pressure to flange thickness and maximum allowable tensile and shearing stresses in material. By means of these formulas flange of usual mushroom type may be designed to withstand safely pressure of rope wound upon drum.

HOUSING

England. Concrete Cottage Building. Concrete and Constructional Eng., vol. 15, no. 11, Nov. 1920, pp. 737-742, 5 figs. Meanwood housing scheme, Leeds.

Industrial. Solving the Housing Problem, Herbert Hoover, Leslie H. Allen, Philip W. Blake and W. Gibbs Astle. Indus. Management, vol. 60, no. 6, Dec. 1920, pp. 425-436, 8 figs. Why industrial executives must do it and how it is being done.

Legislation in England. The Garden City and English Housing Laws, Leonard S. Smith. Eng. and Contracting, vol. 54, no. 21, Nov. 24, 1920, pp. 510-513, 2 figs. Resolutions adopted at World Congress on Housing and Town Planning held in London, June, 1920.

Schemes. Housing and Community Planning, John Irwin Bright. Jl. Am. Inst. of Architects Supp., 8 pp., 4 figs. Scheme developed by Committee on Community Planning of American Institute of Architects.

HYDRAULIC TURBINES

High-Head. Turbines for Niagara's High-Head Plant. Iron Age, vol. 106, no. 23, Dec. 2, 1920, pp. 1453-1457, 11 figs. Normal operating capacity will be 52,500 hp. and net effective head, 305 ft.

Theory of. New Analytical Theory of Water Tupbines. Mech. Eng., vol. 42, no. 11, Dec. 1920, pp. 681-692, 1 fig. Formulas combining various elements of turbines. Translated from Techique Moderne.

HYDROELECTRIC PLANTS

Hydrographic Studies. Hydrographic Study Preliminary to Utilizing the Water Power of a Mountain Basin (Étude hydrographique et aménagement d'un bassin montagneux), G. Malforn. Electricien, vol. 36, no. 1262, Oct. 15, 1920, pp. 433-436, 3 figs. Plan for utilization of basin in Italian Alps. (To be continued.)

Ice Protection. Ice Protection for Hydroelectric Plant, John S. Carpenter. Power Plant Eng., vol. 24, no. 23, Dec. 1, 1920, pp. 1125-1128, 2 figs. Methods of deflecting ice jams.

New Brunswick. Hydro-Electric Power Development in New Brunswick, C. O. Foss. Can. Engr., vol. 39, no. 23, Dec. 2, 1920, pp. 576-578. Two plants of 8000 hp. capacity each. Paper read before Eng. Inst. of Canada.

Nova Scotia. Sheet Harbour Hydro-Electric Powers, Harold S. Johnston. Jl. Eng. Inst. Canada, vol. 3, no. 12, Dec. 1920, pp. 565-575, 4 figs. Schemes proposed with tables of run-off, etc.

South America. Survey of Power Plant Projects in South America. Power Plant Eng., vol. 24, no. 24, Dec. 15, 1920, pp. 1171-1173. Prepared by Guaranty Trust Co. of New York.

Surplus Water. Wasting Surplus Water at Hydroelectric Plants, L. W. Wyss. Power Plant-Eng., vol. 24, no. 23, Dec. 1, 1920, pp. 1125-1128, 3 figs. Description of various kinds of gates used to regulate overflow in hydroelectric stations.

Sweden. Utilizing Hydro-Electric Energy in Sweden. Elec. World, vol. 76, no. 24, Dec. 11, 1920, pp. 1167-1170, 2 figs. Experience with extensive high-tension system of Swedish Government. Method of grading station insulation and studies of lightning trouble. Plans for 200.000-volt transmission lines.

Switzerland. The Great Modern Hydroelectric Plants in Switzerland (Grandi impianti idroelectrici moderni in Isvizzera), Giovanni Rodio. Industria, vol. 34, no. 17, Sept. 15, 1920, pp. 425-431, 14 figs. Utilization of low head of Reno River at Eglisau. Maximum capacity is 42,000 hp. (To be continued.)

Utilization of Freshet Water. Utilizing Freshet Water for Power Generation. Clemens Herschel. Power, vol. 52, no. 22, Nov. 30, 1920, pp. 861-862, 1 fig. With properly designed venturi tube installed in discharge of hydraulic turbine power output can be increased maximum of 30 per cent by utilizing freshet water that would otherwise run to waste over dam.

I

INDUSTRIAL MANAGEMENT

Exposed Records. The Influence of Exposed Records on Output, F. M. Lawson. Eng. & Indus. Management, vol. 4, no. 20, Nov. 11, 1920, pp. 615-617. Permanent advantages are said to be (1) there is less stock carried, which means shorter investment period and consequent saving in money; (2) a smaller staff is required owing to ease with which information can be obtained; and (3) there is less switching men off from one job to another, owing to ease with which accurate decisions can be made.

Inspection. How the Inspection Department Helps the Factory, George S. Radford. Indus. Management, vol. 60, no. 6, Dec. 1920, pp. 418-421. Coordination of inspection with cost, assembling, routing and productivity.

Machine Shops. Finds Efficiency Lacking in Many Shops, H. M. Fitz. Iron Age, vol. 106, no. 25, Dec. 16, 1920, pp. 1609-1611. Inspection trip of 70 shops and factories revealed fact that large percentage has only partial or no system of management.

Opinion of Workers. What the Workers Think About Management—II, Albert Fry. Indus. Management, vol. 60, no. 6, Dec. 1920, pp. 437-440. Opinions from ironworkers, carpenters, inspectors, blacksmiths, machinists, patternmakers and others on individual responsibility, mental and physical tests and co-operation.

Organization Plan. Organization Plan that Typifies Modern Management, S. H. Bullard. Indus. Management, vol. 60, no. 6, Dec. 1920, pp. 441-444, 1 fig. Production system and organization plan of Bullard Machine Tool Co.

Production Method. Small-Quantity Production Methods, Earle Buckingham. Machy. (Lond.), vol. 17, no. 426, Nov. 25, 1920, pp. 213-215, 4 figs. Application of interchangeable manufacturing principles to methods employed when producing machines in limited quantities.

Routing Materials. Rourting Considered as a Function of Up-to-Date Management—III, H. K. Hathaway. Indus. Management, vol. 60, no. 6, Dec. 1920, pp. 445-451, 12 figs. Method of routing assembled, multi-part mechanism.

Statistical Control. Making Statistics Talk—I, M. C. Rorty. Indus. Management, vol. 60, no. 6, Dec. 1920, pp. 394-398, 6 figs. Elements of statistical control. Application of statistical graphic to forecasting future trends.

Time Study. *See Time Study.*

INDUSTRIAL RELATIONS

Business Organization of Labor. Labor as a Business, Not a Commodity—New Plan Proposed to Secure Industrial Peace, George H. Cushing. Manufacturers Rec., vol. 78, no. 21, Nov. 18, 1920, pp. 131-132. Suggests as basic solution for labor difficulty organization of labor on business basis. According to plan suggested capital would contract with labor for a certain amount of work to be done and would pay for it as a unit. Workmen would unite and sell their labor through representatives.

Closed Shop vs. Closed Shop Principles Paramount, James A. Emery. Iron Age, vol. 106, no. 25, Dec. 16, 1920, pp. 1606-1608. Attitude and policy of labor unions during war. (To be continued.) Address delivered before National Founders' Association.

The Closed Union Shop Versus the Open Shop; Their Social and Economic Value Compared, Ernest F. Lloyd. Nat. Indus. Conference Board, no. 11, July, 1920, 27 pp. It is hoped that neither type will prevail or that no class or group may obtain an impregnable hold, but that the industrial conflict may continue to develop a constant approach to unity.

Industrial Democracy. What Makes a Labor Policy Successful? Norman G. Shidle. Automotive Industries, vol. 43, no. 20, Nov. 11, 1920, pp. 970-973, 1 fig. Industrial relations policy of Greenfield Tap & Die Corporation.

New Zealand. Conciliation and Arbitration in New Zealand. Nat. Indus. Conference Board, no. 23, Dec. 1919, 46 pp. Features of New Zealand legislation, and its operation in practice.

Open Shop. The Last Stand of the Open Shop, Roy W. Hinds. Coal Age, vol. 18, no. 21, Nov. 18, 1920, pp. 1037-1040, 2 figs. Developments of strike in coal fields of southern West Virginia and Kentucky.

The Open Shop Fight is a Fight for American Independence—The Closed Shop un-American and Destructive of all Individual Independence. Manufacturers Rec., vol. 78, no. 21, Nov. 18, 1920, pp. 106-108. Progress of movement for open shop throughout the United States.

Works Councils. A Works Council Manual. Nat. Indus. Conference Board, no. 26, Feb. 1920, 32 pp., 4 figs. Procedure for establishing works council.

Works Councils in the United States. Nat Indus. Conference Board, no. 21, Oct. 1919, 135 pp. Results of Studies of works councils in 225 American industrial establishments. Information is brought down to August 1, 1919.

INDUSTRIAL TRUCKS

Transveyor. The Cowan Transveyor. Eng. and Indus. Management, vol. 4, no. 19, Nov. 4, 1920, pp. 598-600, 3 figs. Type of industrial truck for interdepartmental conveying, used in various British works.

INDUSTRY

Germany. Problems of Labor and Industry in Germany. Nat. Indus. Conference Board, no. 15, Sept. 1920, 65 pp. Open shop principle has been recognized as basis for all relations between employer and employee, in spite of the fact that labor is almost completely organized and the Government has been encouraging organization among employers and employees.

INSULATORS, HEAT

Hot-Air-Pipe Coverings. The Insulating Value of Various Coverings for Hot Air Pipes as Determined by Tests at the University of Illinois. Am. Architect, vol. 118, no. 2343, Nov. 17, 1920, pp. 648-652, 4 figs. It is concluded that use of thin sheets of asbestos paper on bright tin heat pipes results in waste of heat. Uncovered bright tin pipes were found to be more efficient carriers of heated air. Accumulation of dust and dirt on pipes does not greatly alter amount of loss. It is advised that unless insulation excels uncovered bright tin in heat insulation properties it should not be used.

INTERNAL-COMBUSTION ENGINES

Fuel Combustion. The Combustion of Fuels in the Internal-Combustion Engine, Thomas Midgley, Jr. Jl. Soc. Automotive Engr., vol. 7, no. 6, Dec. 1920, pp. 489-497 and (discussion) pp. 497-499, 18 figs. Recently developed optical gas-engine indicator. Indicator cards obtained with different fluids. Theory of knock and of knock suppressors.

Ignition. *See Ignition.*

Lubrication. Castor Oil (L'huile de ricin), M. Martinot-Lagarde. Aéronautique, vol. 2, no. 17, Oct. 1920, pp. 187-190. Its value as lubricant for internal-combustion engines.

Water Injection. Water Injection in Gas and Oil Engines. Automobile Eng., vol. 10, no. 145, Dec. 1920, pp. 492-494. Consideration of application and effect.

See also Aeroplane Engines; Automobile Engines; Diesel Engines; Gas Engines; Gasoline Engines; Heavy-Oil Engines.

IRON

Electrodeposited. The Industrial Future of Electro-Deposited Iron, W. E. Hughes. Elecn., vol. 85, no. 2216, Nov. 1920, pp. 530-532, 4 figs. Developments in Europe.

Plates. Standard Specifications for Wrought-Iron Plates. U. S. Dept. Commerce, Bur. Foreign and Domestic Commerce, Industrial Standards, no. 27, 1918, 13 pp. Adopted by American Society for Testing Materials.

IRON ORE

World Supply. The Iron Ore Supplies of the World, F. H. Hatch. Geol. Mag., vol. 57, no. 677, Nov. 1920, pp. 504-517. Statistics by countries. From Lond. Times Trade Supp.

IRRIGATION

Flumes. Cement Plaster Lining For Wood Irrigation Flumes, Everett N. Bryan. Eng. News-Rec., vol. 85, no. 23, Dec. 2, 1920, pp. 1090-1092, 1 fig. Experience on three flumes aggregating 1560 ft. indicates success at cheaper cost than all-wood flume.

L

LABOR

Concervation of. Conservation of Labor, L. W. Wallace. Am. Mach., vol. 53, no. 24, Dec. 9, 1920, pp. 1104-1106. Address delivered at first meeting of American Engineering Council of Federated American Engineering Societies.

Hours of Work. Unwarranted Conclusions Regarding the Eight-Hour and Ten-Hour Workday. Nat. Indus. Conference Board, no. 14, Aug. 1920, 21 pp. Critical review of "Comparison of an Eight-Hour Plant and a Ten-Hour Plant," United States Public Health Bul. no. 106. It is claimed that conclusions presented therein are unscientific and unjustified by data offered, because the two plants from which data were obtained are not fairly comparable and basis of experience is too small to justify complete conclusions applicable to industry in general.

Strikes. *See Strikes.*

Two-Shift vs. Three-Shift Day. The Development of the Technique of Changing from the Two-Shift to the Three-Shift Day in a Continuous Process, Robert B. Wolf. Jl. Engrs. Club of Phila., vol. 37-12, no. 192, Dec. 1920, pp. 463-469 and (discussion) pp. 469-478, 6 figs. Results obtained in three plants where change was made are illustrated and interpreted and suggestions are given in regard to changes in management policy which should accompany change to three shifts.

LABOR TURNOVER

New York City. Labor Turnover in New York City, Am. Mach., vol. 53, no. 21, Nov. 13, 1920, pp. 933-935, Statistics.

LABORATORIES

Aerodynamic. The New Testing Apparatus at the Airdynamic Institute at Saint-Cyr (Les Nouveaux Appareils d'Essais de l'Institut Aérotechnique de Saint-Cyr. Nature (Paris), no. 2426, Oct. 2, 1920, pp. 213-219, 10 figs. Airdynamic balance, wind tunnel and apparatus for testing propellers.

LAPPING

Modern Practice. Modern Lapping Practice. Machy. (Lond.), vol. 17, no. 423, Nov. 4, 1920, pp. 129-137, 19 figs. Developments in lapping practice; including abrasives used in lap-charging methods, lapping thread gages, snap gages, measuring wires, flat surfaces, ring gages, die-casting dies and T-slots.

LATHES

Automatic. Recent Machine Tool Developments—XVII, Joseph Horner. Eng. vol. 110, no. 2864, Nov. 19, 1920, pp. 660-664, 10 figs. Types of automatic lathes.

Turret. Efficient Automatic Machine Tool Records, F. Scriber. Can. Machy., vol. 24, no. 24, Dec. 9, 1920, pp. 513-514, 6 figs. Skeleton set-ups on turret chucking lathe are explained.

Using Turret Lathes in Railroad Shops, J. H. Moore. Can. Machy., vol. 24, no. 21, Nov. 18, 1920, pp. 447-451, 7 figs. Examples of their application of various kinds of work.

LIGHTING

Industrial. Some Out of the Ordinary Applications of Industrial Lighting, Samuel G. Hibben. Trans. Illuminating Eng Soc., vol 15, no. 8, Nov. 20, 1920, pp. 591-598 and (discussion), pp. 598-602, 17 figs. Recommendations in regard to method of mounting lamps.

LIME

Plaster. The Popping (Unsoundness) of Lime Plaster, Warren E. Emley and Cecil H. Bacon. Jl. Am. Ceramic Soc., vol. 3, no 11, Nov. 1920, pp. 877-884. Methods of testing lime for soundness. Record of tests at Bureau of Standards. It is concluded that popping of lime plaster is caused by presence fo grains of Material which hydrates slowly and expands as it hydrates.

LOCOMOTIVES

Articulated. Recent Types of Articulated Locomotives (Types récent de locomotives articulées). Lionel Wiener. Revue générale des Chemins de Fer, vol. 39, no. 3, Mar. 1920, pp. 155-210, 16 figs. European and American developments.

Driving Box Shoes. Lining Driving Box Shoes and Wedges, J. McAllister. Ry. Mech. Engr., vol. 94, no. 12, Dec. 1920, pp. 788-791, 1 fig. Shoe and wedge layout. Pedestal jaw grainding machine.

Inspection. Report of the Bureau of Locomotive Inspection. Ry. Age, vol. 69, no. 25, Dec. 17, 1920, pp 1071-1073, 1 fig. Outstanding feature of report of chief inspector of locomotives to Interstate Commerce Commission for fiscal year ending June 30, 1920, is increase in number of accidents and casualties resulting from failures of parts of locomotives and tenders. Application of water columns and other devices advocated.

Steam vs. Electric. Relative Advantages of Modern Steam and Electric Locomotives. Jl. Am. Inst. Elec. Engrs., vol. 39, no. 12, Dec. 1920, pp. 1044-1048. Comparison of two types, based on actual method of operation. Discussion at joint meeting of New York Sections of American Institute of Electric Engineers and Am. Soc. M. E.

Steam vs. Electric Locomotives, John E. Muhlfeld, F. H. Shepard, A. H. Armstrong. Mech. Eng., vol. 42, no. 12, Dec. 1920, pp. 680-687 and (discussion) pp. 687-688 and p. 726, 1 fig. Comparison in regard to initial and maintenance costs, reliability of service, efficiency of operation, and suitability of design. Data obtained in actual service of both types are presented and discussed.

Superheater. Steam Distribution with Superheated Steam. Ry. and Locomotive Eng., vol. 33, no. 12, Dec. 1920, pp. 368-370. Experiments made by French engineers in use of rotating valves. Translated from Génie Civil.

M

MACHINE TOOLS

Electric Equipment, Standardization of. Standardization of Electrical Equipment on Machine Tools. Iron Age, vol. 106, no. 21, Nov. 18, 1920, pp. 1322-1324 and pp. 1369-1371. Advantages of individual drive. Suggestions in regard to standardization.

Lead Screws. Precision Lead Screws. Machy. (Lond.), vol. 17, no. 423, Nov. 4, 1920, pp. 125-128, 5 figs. Grinding and inspection methods of Drummond Bros., Guildford, England.

Sawmill Machinery. Building Saw Mill Machinery, Fred. H. Colvin. Am. Mach., vol. 53, no. 23, Dec. 2, 1920, pp. 1030-1032, 7 figs. Machine-tool equipment in typical plants in Pacific Coast States.

Small Machines. Small Machines for Building Optical Instruments, J. V. Hunter. Am. Mach., vol. 53, no. 20, Dec. 2, 1920, pp. 1045-1047, 6 figs. Miniature machines for use in manufacture of delicate instruments.

MACHINERY

Foundations. Foundations for Machinery, N. W. Akimoff. Mech. Eng., vol. 42, no. 12, Dec. 1920, pp. 671-672 and p. 699, 3 figs. Theory of causes leading to vibrations of machinery. Means for localizing excepted vibration and of controlling resulting periods.

MALLEABLE IRON

American Industry. American Malleable Cast Iron—I, H. A. Schwartz. Iron Trade Rev., vol. 67, no. 23, Dec. 2, 1920, pp. 1536-1540, 4 figs. Series of related articles dealing with development of industry. Modern methods of manufacture, metallurgical principles involves and properties of American malleable iron.

Research. *See Research, Malleable Iron.*

MARINE BOILERS

Manufacture. Conference on the Unification of Rules for the Construction of Marine Boilers and Steam Pipes. Steamship, vol. 32, no. 378, Dec. 1920, pp. 153-155, 3 figs. Standard conditions for design and construction of marine boilers issued by British Board of Trade, 1920. (To be continued.)

MATERIALS

Substitutes for Various. German War Substitutes, A. Belter. Sci Am. Monthly, vol. 2, no. 4, Dec. 1920, pp. 333-336. Substitutes for metals, gasoline and benzine, lubricants and rubber. Translated from Industrie Chimique.

Testing. *See Notched-Bar Tests.*

MILLING

British Practice. Milling Operations on Herbert Lathes, I. W. Chubb. Am. Mach., vol. 53, no. 21, Nov. 18, 1920, pp. 945-950, 22 figs. Practice in British shops.

MILLING CUTTERS

Helical. Making "Curvex" Milling Cutters. Machy. (Lond.), vol. 17, no. 425, Nov. 18, 1920, pp. 188-196, 17 figs. Methods and equipment employed by Pratt & Whitney Co. in manufacture of formed milling cutters with helical flutes.

MILLING MACHINES

Tables. Making Milling Machine Tables, Leroy M. Sherwin. Foundry, vol. 48, no. 23, Dec. 1, 1920, pp. 953-956, 7 figs. Molding and melting practices. Paper read before Am. Foundrymen's Assn.

MOLDING METHODS

Flasks for Locomotive Frames. How a Long Steel Flask is Assembled, Geo. W. Childs. Foundry, vol. 48, no. 22, Nov. 15, 1920, pp. 923-925, 5 figs. Method of assembling sections of flasks used in molding locomotive engine frames.

MOTOR PLOWS

British-Made. Improved Mechanical Ploughing Appliances. Engr., vol. 100, no. 3383, Oct. 29, 1920, pp. 423 and 434-435, 6 figs. Motor cable plowing outfit manufactured by John Fowler & Co., Leeds, England.

MOTOR TRUCKS

Body Standardization. Now is the Time for Standardization in Truck Body Measurements, J. Edward Schipper. Automotive Industries, vol. 43, no. 20, Nov 11, 1920, pp. 962-963, 2 figs. Advantages of standardization. It is said that in addition to making lower price, it will be possible to make more competent and stable body building industry.

German German Mechanical Transport Vehicles, Automobile Engr., vol. 10, no. 145, Dec. 1920, pp. 466-477, 35 figs. Notes on collection of captured vehicles at Aldershot, England.

Olympia Show. The Commercial Motor Exhibition. Automobile Engr., vol. 10, no. 194, Nov. 1920, pp. 440-444, 11 figs. Trend of design in heavy vehicles as shown in exhibition at Olympia Show.

Specifications. Internal-Combustion Truck Specifications. Power Wagon, vol. 25, no. 193, Dec. 1920, pp. 42-59. Principle characteristics of 504 makes.

Tipping Gears. Tipping Gears for Lorries—II, Colliery Guardian, vol. 120, no. 3122, Oct. 29, 1920, pp. 1230-1232, 10 figs. British design.

MOTORCYCLES

Springing. The Springing of Motor Cycles, C. H. Savage. Automobile Engr., vol. 10, no. 144, Nov. 1920, pp. 457-462, 17 figs. Discussion of experiments made in France. From results obtained suggestions are made in regard to position of springs and their dimensions.

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NICKEL-CHROMIUM ALLOYS

Types. Nickel-Chromium Alloys, Leon O. Hart. Min. and Metallurgy, no. 168, Dec. 1920, p. 39. Properties of various types used. (Abstract.)

NOTCHED-BAR TESTS

Impact Tests. Experimental Study of Impact Tests on Notched Bars (Etude expérimentale sur les essais au choc des barreaux entaillés), André Cornu-Thenard. Revue de Métallurgie, vol. 17, no. 9, Sept. 1920, pp. 584-614, 40 figs. Influence of speed of impact on results of tests. (Continuation of serial.)

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OIL FUEL

Burning in Steam Cars. Liquid Fuel on Steam Waggons. Motor Traction, vol. 31, no. 819, Nov. 8, 1920, pp. 527-528, 3 figs. Application of Scarab liquid fuel system to Foden steam car.

Refining Practice. Refining Problems, H. H. Hill. Reports of Investigations, Bur. of Mines, Dept. of Interior, serial no. 2180, Nov. 1920, 11 pp. Possibilities of increasing yield of oil in refineries.

Ships. Fuel Oil for Steamers, C. H. Peabody. Mar. Eng., vol. 25, no. 12, Dec. 1920, pp. 997-998. Grades of oil available for merchant vessels and their use. Recent Advance in Oil Burning, Ernest H. Peabody. Twenty-eighth General Meeting, Soc. Naval Architects & Mar. Engrs., Nov. 11 and 12, 1920, no. 9, 11 pp., 8 figs. Progress in oil burning in ships of U. S. Navy. Graphs showing present efficiency obtained in boiler and furnace are included.

OXY-ACETYLENE CUTTING

Cast Iron. Cast Iron Cutting with Oxweld Blowpipe. Acetylene Jl., vol. 22, no. 6, Dec. 1920, pp. 318-322, 8 figs. Procedure.

Cutting Cast Iron with the Oxy-Acetylene Torch, Alfred S. Kinsey. Welding Engr., vol. 5, no. 11, Nov. 1920, pp. 34 and 36-37, 4 figs. Following points are emphasized: Cast iron can be cut'"' by combined melting-oxidizing action of oxy-acetylene torch; cutting of cast iron, even though rather roughly done, will be of fine advantsge to shop practice in several ways; special cutting torch is unnecessary provided one is used which operates with excess acetylene, etc.

OXY-ACETYLENE WELDING

School for. Michigan State Auto School's Special Welding and Brazing Course. Acetylene Jl., vol. 22, no. 6, Dec. 1920, pp. 315-317, 4 figs. Methods of instruction at oxy-acetylene welding school.

OXYGEN CUTTING

Jet-Cutting Machine. The Godfrey Jet-Cutting Machine. Machy. (Lond.), vol. 17, no. 425, Nov. 18, 1920, pp. 185-187, 4 figs. Machine tool using jet of oxygen as cutting medium. Manufactured by Godfrey Engineering Works, England.

P

PAPER MANUFACTURE

Pope Patent. A Description of the Pope Patent. Paper vol. 27, no. 10, Nov. 10, 1920, pp. 28-30, 8 figs. Invention relates to means for winding web of paper produced by paper-making machine onto winding-roll.

PATTERN MAKING

Shops. Rehabilitate Shop in Record Time. Foundry, vol. 48, no. 22, nov.. 15, 1920, pp. 897-901, 7 figs. Organization and equipment of patternmaking shop of Bryan Pattern & Machine Co., Bryan, Ohio.

PAVEMENTS

Broken-Stone Foundations. Specifications for Broken Stone Foundations. Public Works, vol. 49, no. 20, Nov. 13, 1920, pp. 452-453. Also Engineering & Contracting, vol. 54, no. 22, Dec. 1, 1920, pp. 539-540. Specifications prepared by chief engineer of Chicago South Park Commission and approved by Committee on Foundations for Pavements of American Society for Municipal Improvements.

PAVEMENTS, BITUMINOUS

Macadam Base. Macadam Base for Bituminous Pavements. Public Works, vol. 49, no. 20, Nov. 13, 1920, pp. 449-451, 3 figs. Factors affecting strength and durability of pavements on macadam base, including strength of base, supporting power of earth and traffic to be carried. Attention is called to undesirable practices, especially insufficient protection of shoulders.

Patches. Good and Bad Practice in Making Bituminous Patches, John Stanley Crandell. Eng. News-Rec., vol. 85, no. 25, Dec. 16, 1920, pp. 1168-1170, 4 figs. Suggestion in regard to procedure.

PAVEMENTS, CONCRETE

Specifications. Specifications for Concrete Pavements. Eng. World, vol. 17, no. 6, Dec. 1920, pp. 409-410. Recommendations of Committee on Specifications of American Society for Municipal Improvements.

PAVEMENTS, WOOD-BLOCK

Failures. Recent Experiences with Wood Block Pavements. Eng. News-Rec., vol. 85, no. 21, Nov. 18, 1920, pp. 976-977. Analyses of recent failures with suggestions as to prevention. Pitch-coated base under tightly laid blocks best.

PETROLEUM

Bibliography. Recent Articles on Petroleum and Allied Substances, E. H. Burroughs. Reports of Investigations, Bur. of Mines, Dept. of Interior, serial no. 2188, Nov. 1920, 23 pp.

PILE DRIVERS

Steam vs. Drop Hammers. Pile Driving Results with Steam and Drop Hammers Compared. Eng. News-Rec., vol. 85, no. 22, Nov. 25, 1920, pp. 1027-1028, 3 figs. Records of weekly performances gives drop hammer an average of 35.7 piles per 8-hr. day and steam hammer working under same conditions with 13,000-lb. steam hammer, 48 piles per day.

PISTON RINGS

Design. Piston-Rings, L. G. Nilson. Jl. Soc. Automotive Engrs., vol. 7 no. 6, Dec. 1920, pp. 525-531 and (discussion) pp. 531-536, 22 figs. Survey of developments in design. Specifications for material for piston rings.

PLANERS

Sellers 16-ft. The Sellers 16-ft. Planer. Am. Mach., vol. 53, no. 22, Nov. 25, 1920, pp. 973-976, 3 figs. Planer, weighs nearly one-half million pounds and was recently completed by William Sellers & Co., for large shipbuilding company.

POWER FACTOR

Correction. Power Factor Correction by Synchronous Motors, Victor H. Todd. Power Plant Eng., vol. 24, no. 24, Dec. 15, 1920, pp. 1174-1176, 5 figs. Graphical methods.

Improvement of. Improving Power Factor Conditions with Induction Motors, R. G. Warner and A. E. Knowlton. Elec. World, vol. 76, no. 21, Nov. 20, 1920, pp. 1021-1022, 4 figs. Advantages to be derived from transformation of phase-wound-rotor type of induction motor to synchronous motor, with field current derived from adjacent exciter.

POWER TRANSMISSION

Sonic Waves. Transmission of Energy by Vibrations of Liquids in Conduits (Sur la transmission de l'énergie par les vibrations de liquides dans les conduits), C. Carmichel, D. Eydoux and A. Foch. Comptes rendus des Séances de l'Académie des Sciences, vol. 171, no. 17, Oct. 26, 1920, pp. 783-786. Technical study of power transmission by Constantinesco system of sonic waves.

PRESSES

Briquetting Cast-Iron Turnings. The "Boreas" Briquetting Press for Cast-Iron Turnings. Eng., vol. 110, no. 2863, Nov. 12, 1920, p. 638. 3 figs. Made in Copenhagen by Danish Machine Co. Finished briquets are in form of truncated cones and each weighs about 6½ lb.

Safety Device. Making the Punch Press Safe and Efficient, Norman G. Shidle. Automotive Industries, vol 43, no. 23, Dec. 2, 1920, pp. 1118-1120 and 1133. Examples of safety devices used.

Tools. Press Tools for Caterpillar Parts. Frank A. Stanley Am Mach, vol. 53, no 22, Nov. 25, 1920, pp 987-988, 5 figs. Processes in manufacture of articles made from sheet metal or tubing.

PROFIT SHARING

Experience. Practical Experience with Profit Sharing in Industrial Establishments. Nat. Indus. Conference Board, no. 29, June 1920, 88 pp. Causes and circumstances which make some profit-sharing plans fail and others succeed.

Lyons Congress. Profit Sharing Recommended at Congress of Lyon (La participation aux bénéfices.—Le congrès de Lyon), F. Bayle. Revue générale de l'Électricité, vol 8, no. 21, Nov. 20, 1920, pp. 735-739. Discussion of profit sharing as means for remedying industrial situation at Congress held at Lyon, October 1-2, 1920.

PULVERIZED COAL

Combustion. Pulverized Coal as Fuel. Lawford H. Fry. Eng., vol. 110, no. 2863, Nov. 12, 1920, pp. 628-631, 5 figs. Principles involved in combustion.

Grindle Burning System. For Burning Powdered Coal. Iron Age, vol. 106, no. 25, Dec. 16, 1920, pp. 1614-1615, 2 figs. Grindle equipment for burning powdered coal, manufactured by Combustion Economy Corporation, Chicago.

PUNCHING MACHINES

Tooling Arrangement. Two Light Punching-Machine Jobs, John Simon. Am. Mach., 53, no. 24, Dec. 9, 1920, pp. 1075-1077, 7 figs' Tooling practice in Austrian Machine Shop.

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RADIOMETALLOGRAPHY

Methods. Examination of Materials by X-Rays (Emploi des rayons X pour l'examen des matériaux). Ouvrier Moderne, vol. 3 no 8, Nov. 1920, pp. 309-314, 11 figs. Apparatus employed and results obtained.

RAILS

Failures. Decrease in Rail Failures Confirmed by Latest Statistics. Eng. News-Rec., vol. 85, no. 23, Dec. 2, 1920, p. 1071, 1 fig. Statistics of rail failures for principal carriers.

Wheel Pressures and Steel Rail Failures. Iron Age, vol. 106, no. 22, Nov. 25, 1920, pp. 1399-1400. Report of Committee on Safety of Railroad Operation to convention of National Association of Railway and Utilities Commissioners. Heat treatment suggested as remedy for failures.

Sink-Heat vs. Ordinary Ingots. Steel Rails from Sink-Heat and Ordinary Rail Ingots—III, George K Burgess. Chem. and Metallurgical Eng., vol. 23, no. 21, Nov. 24, 1920, pp. 1017-1022, 10 figs. Physical tests, metallographical examinations and chemical surveys. Comparison rails performed much better under drop test, and showed less abrasion under service tests.

RAILWAY ELECTRIFICATION

Holland. Electrification in the Netherlands (L'électrification des Pays-Bas), J.-C. Van Staveren. Vie Technique et Industrielle, vol. 1, no. 9, June 1920, pp. 204-206, 1 fig. Résumé of report of high tension committee appointed by association of directors of electric companies in Netherlands.

Switzerland. Railway Electrification of the Erstfeld-Bellinzona Railway (Électrification de la ligne Erstfeld-Bellinzone). Bulletin Technique de la Suisse Romande, vol. 46, no 21. Oct. 16, 1920, pp. 241-246, 5 figs. General description of works with notes on electric locomotive used.

The Electrification of the Gothard Railway. Ry. Gas., vol. 33, no. 21 Nov. 19, 1920, pp. 668-670, 3 figs. Line is 139½ miles long.

RAILWAY MAINTENANCE

Filling Bridges. Maintenance of Structures in Filling Bridges. Ry. Rev., vol. 67, no. 20, Nov. 13, 1920, pp. 731-736. Report of committee to American Railway Bridge Association.

RAILWAY OPERATION

Emergency Car Service. Annual Report of Interstate Commerce Commission. Ry. Age, vol. 69, no. 24, Dec. 10, 1920, pp. 1019-1023. Review of year's activities under new law, including exercise of emergency car-service powers.

RAILWAY SIGNALING

Angereau System. Repetition of Signals on the Locomotive (Répétition des signaux sur les locomotives), F Limon and G. Lebaupin. Annales des Mines, vol. 10, no. 9, 1920, pp. 245-256, 1 fig. Angereau radio-telegraphic system, employed by French railways, for repetition of signals on locomotive.

Three-Position Automatic System. The Signalling of the Ealing & Shepherd's Bush Railway. Ry. Gaz., vol. 33, no. 18, Oct. 29, 1920, pp. 571-577, 13 figs. Installation of three-position automatic signaling system, including special features with regard to control and working of signals and operation and detection of points.

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Construction. On the Question of the Construction of the Road Bed and of the Track (Subjected for Discussion at the Ninth Congress of the International Railway Association), Mr. Henry and Mr. Candelier. Bul. Int. Ry. Assn., vol. 2, no. 10, Oct. 1920, pp. 639-664, 20 figs. Based on replies to questionnaire sent out to railway companies in Belgium, Bulgaria, Spain, France, Portugal and Switzerland. Questions referred to deformation noticed in track, amount of traffic carried, measures adopted and results obtained.

Design. Railway Track Design. Ry. Gaz., vol. 33, no. 20, Nov. 12, 1920, pp. 637 and 644. Compares bull-head with flat-bottom track, and suggests that advantages of latter justify its adoption in England.

Standardizing Work. Methods of Standardizing Track Work, Earl Stimson. Ry. Rev., vol. 67, no. 22, Nov. 27, 1920, pp. 813-816. Experience of Baltimore & Ohio Railroad.

RAILWAYS

Equipment Performance. A Remedy for Our Transportation Ills, O. W. Stiles. Freight Handling & Terminal Eng., vol. 6, no. 8, Aug. 1920, pp. 291-294. Organization of equipment performance as means for increasing service.

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REDUCTION GEARS

Design. Propelling Machinery for the New Cunarders. Shipbuilding & Shipping Rec., vol. 16, no 22, Nov. 25, 1920, pp. 631-633, 4 figs. Double-reduction geared turbines for "Scythia," "Laconia" and other vessels.

REFRIGERATING PLANTS

Fish Storage. Plant for Refrigerating Fish at Lorient, France (Le frigorifique à poissons de Lorient, Morbihan), M Verrière and M. Tayon Génie Civil, vol. 77, no. 13, Sept. 25, 1920, pp 245-250, 16 figs. partly on supp. plate Data. Storage capacity, 2000 tons of fish; ice-making capacity, 120 tons of ice per day.

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Malleable Iron. British Grey and Malleable Cast-Iron Research Association. Foundry Trade Jl., vol. 22, no. 227, Nov. 1920, pp. 839-846. Account of inaugural meeting held at Birmingham, England, on Sept. 30, 1920.

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RIVETED JOINTS

Stresses in. Determining True Net Sections of Riveted Tension Members by Diagrams. Can. Engr., vol. 39, no 20, Nov. 11, 1920, pp. 512-513, 4 figs. Graphs give theoretically correct deductions of rivet holes for various gages and staggers.

RIVETING

Machines. English Type Electric Riveting Machine. Boiler Maker, vol. 20, no. 11, Nov. 1920, pp. 317-318, 5 figs. Manufactured by Mada Engineering Co.

Oiltight Work. Notes on Rivets and Spacing of Rivets for Oil-Tight Work Hugo P. Frear. Twenty-eighth General Meeting, Soc. Naval Architects and Mar Engrs., Nov. 11 and 12, 1920, no. 5, 10 pp. Rules and recommendations of American Bureau of Sipping, Bureau Veritas and Lloyd's Register.

Notes on Rivets and Spacing of Rivets for Oiltight Work, Hugo P. Frear. Mar. Eng., vol. 25, no. 12, Dec. 1920, pp. 1008-1009. Information concerning oiltight practice of riveting for oiltight work. (Abstract.) Paper read before Soc. Naval Architects & Mar. Engrs.

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Relative Service. Relative Service Value of Pavement Types. Eng. News-Rec., vol. 85, no. 25, Dec. 16, 1920, pp. 1187-1190. Discussion of relative service value of different types of rural roads

ROAD CONSTRUCTION

Progress Records. Reports and Records of Delaware Highways. Public Works, vol. 49, no. 23, Dec. 4, 1920, pp. 537-540, 6 figs. Forms used by State Highway Department of Delaware in obtaining and recording daily reports from engineers and inspectors on progress of work, in preparing monthly estimates, etc. Also daily reports of traffic patrol.

Surface Course. Surfacing the Modern Road (Le revêtement de la route moderne). G. Dumont and L. Auscher. Génie Civil, vol. 77, no. 21, Nov. 20, 1920, pp. 405-408, 5 figs. Methods of applying bituminous asphaltic surface course.

ROLLING MILLS

Alloy-Steels. New Rolling Mill for Alloy Steels. Iron Age, vol. 106, no. 25. Dec. 16, 1920, pp. 1597-1599, 6 figs. Installation of Pennsylvania Forge Co., Bridesburg, Philadelphia. Five stands are served by tilting table on one side and traveling lifting table on other with runount over transfer table.

Electrically Driven. Electric Rolling-Mill Equipment for Messrs. Steel, Peech & Tozer, Ltd. Elec. Rev. (Lond.), vol. 87, no. 2244, Nov. 26, 1920, pp. 675-677, 5 figs. Billet mill is of Morgan type and consists of four stands of 21-in. rolls and stands six of 18-in. rolls, and is driven by 1200 hp., 6300-volt, 3-phase, 50-cycle B.T.H. slip-ring type induction motor. (Concluded.)

Factors which Determine the Selection of Motors for Main Roll Drive. G. E. Stoltz. Proc. Engrs. Soc. Western Pa., vol. 36, no. 7, Oct. 1920, pp 492-507 and (discussion), pp. 508-517, 17 figs. Examination of types used in various steel mills. Suggestions in regard to selecting type of motor for proposed installation.

Motor Equipment for Main Drive of Rolling Mills. Elecn., vol. 85, no. 2216, Nov. 5, 1920, pp. 541-547. List giving particulars of British electrically driven rolling mills.

Notes on Rolling Mill Drives, L. Rothera. Elecn., vol. 85, no. 2216, Nov. 5, 1920, pp. 514-517, 5 figs. Examples showing progressive increase in motor size.

Sheet and Tin Mills, A. B. Holcomb. Assn. Iron & Steel Elec. Engrs., vol. 2, no. 11, Nov. 1920, pp. 1-11 and (discussion) pp. 11-27. Advantages of electric drive for sheet and tin mills.

The Electric Drive of Rolling Mills, W. E. Taylor and C. E. Raeburn, Elecn., vol. 85, no. 2216, Nov. 5, 1920, pp. 524-528, 3 figs. Comparative economy of steam and electric drives. Based on records of operation of Canadian mill by steam drive and after its conversion to electric drive.

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Variable Speed Rolling Mill Drives, W. E. Swale. Elecn., vol. 85, no. 2216, Nov. 5, 1920, pp. 522-523, 3 figs. Relative advantages of direct and alternating current.

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Shop, Organization for. Safety Work Must be Well Planned, R. A. Salisbury. Foundry, vol. 48, no. 22, Nov. 15, 1920, pp. 895-896. Devise organized committees under direction of safety engineers and changing membership of committees frequently in order to educate workmen in safety.

Steel Works, Organization for. "Safety First" in a Steel works, H. S. Burn. Eng. and Indus. Management, vol. 4, no. 19, Nov. 4, 1920. pp. 589-590. Organization in large British Steel Works employing about 4000 workers.

SAND, MOLDING

Analysis. Judging Sands for Foundry Use—IV Henry B. Hanlet and Herbert R. Simonds. Foundry, vol. 48, no. 22, Nov. 15, 1920 pp. 921-922. Methods of testing.

SCIENTIFIC MANAGEMENT

See Industrial Management.

SCREW THREADS

Specifications. Report on Coarse and Fine Threads. Can. Machy., vol. 24, no. 17, Oct. 21, 1920, pp. 374-377. Tables of tolerances and specifications.

SCREWS

Standards. Report of the German Industry Committee on Standards (Mitteillungen des Normenausschusses der Deutschen Industrie), Betrieb, vol. 3, no. 1, Oct. 10, 1920, pp. 1-14, 17 figs. Proposals of the Board of Directors for special standard dimensional values and for driver's seat in agricultural machines. Proposed standards for square and hexagon head Whitworth cap screws, bolts and nuts, lag screws; sink-water traps, etc. Rules of the Committee standards and formula values.

SEWAGE DISPOSAL

Dorr System. Dorr System of Sewage and Trade Waste Treatment, R. H. Eagles. Jl. Boston Soc. Civil Engrs., vol. 7, no. 9, Nov. 1920, pp. 245-262 and (discussion) pp. 262-271, 5 figs. Advantages of applying continuous sedimentation and mechanical sludge removal in connection with sewage treatment. Results obtained by use of Dorr continuous thickener.

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Production Systems. Production Methods in Shipbuilding—V, William. B. Ferguson. Indus. Management, vol. 60, no. 6, Dec. 1920, pp. 409-412, 2 figs. Discusses piece work in its application to shipbuilding and shows how varied nature of work involving many trades makes it necessary to depart from any one hard and fast system of bonus payment. Application of Halsey premium systems and 100 per cent time premium plan and results obtained therefrom in increasing output of yard are set forth.

SNOW PLOWS

Rotary. The Development of Snow Fighting Equipment, W. H. Winterrowd. Ry. Maintenance Engr., vol. 16, no. 12, Dec. 1920, pp. 458-462, 8 figs. Rotary plows of Canadian Pacific Railways.

STEAM

Formulas. Steam Formulas, Robert C. H. Heck. Mech. Eng., vol. 42, no. 12, Dec. 1920, pp. 669-670, 4 figs. Critical comparison of various existing formulations and development of new set of general equations. Formulæ are developed for temperature, pressure and heat content.

Generation by Solar Rays. *See Solar Energy.*

Superheated in Textile Mills. Superheated Steam in Textile Power Plants, Pell W. Foster, Jr. Textile World, Jl., vol. 58, no. 23, Dec. 4, 1920, pp. 113-117, 4 figs. Its adaptability to the problems of textile-mill engineer.

STEAM ENGINES

Piston Displacement. Piston Displacement, Velocity and Acceleration for Reciprocating Engines, John L. Bogert. Mar. Eng., vol. 25, no. 12, Dec. 1920, pp. 983-989, 10 figs. Table and graphs giving piston displacement, velocity and acceleration for various rations of connecting rod to crank.

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STEAM POWER PLANTS

Test Codse. Power Test Codes. Mech. Eng., vol. 42, no. 12, Dec. 1920, pp. 718-719 and p. 725. Preliminary draft of first of 19 codes which the American Society of Mechanical Engineers Committee on Power Test Codes is formulating.

STEAM TURBINES

Operation and Adjustment. Operation and Adjustment of Turbine Machinery—XII—Oil Pumps, Eustis H. Thompson. Power, vol. 52, no. 22, Nov. 30, 1920, pp. 863-864, 3 figs.

STEEL

Aircraft. Some Notes on Aircraft Steels and Their Inspection, R. K. Bagnall-Wild. Flight, vol. 12, no. 45, nov. 4, 1920, pp. 1157-1158, 2 figs. British Air Board specifications. Paper read before Cambridge University Aeronautical Soc.

Alloy. *See Alloy Steels.*

Automobile. Automobile Steels. Ironmonger, vol. 172, no. 2451, Nov. 6, 1920, pp. 111-112. Report of Steel Research Committee founded by Institution of Automobile Engineers and Society of Motor Manufacturers and Traders on investigation conducted to establish mechanical properties of Bright Standard Wrought Automobile Steels. (Abstract.)

Basic. Reversion of Phosphorus to Basic Steel in the Ladle, Henry D. Hibbard. Blast Furnace & Steel Plant, vol. 8, no. 12, Dec. 1920, pp. 642-643. Conditions upon which quantity of phosphorus to revert depends. Fundamental cause of reversion of phosphorus due to presence of reducing elements.

Carbonization. Carbonizing So As to Insure a Tough Core, Earl W. Pierce and John W. Anderson. Iron Age, vol. 106, no. 21, Nov. 18, 1920, pp. 1315-1316. New method of carbonizing straight low carbon steel with carbon content varying from 0.15 to 0.25 per cent.

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On the Saturation Value of Magnetisation of Cementite, Seizô Saitô. Sci. Reports of the Tôhoku Imperial University, vol. 9, no. 4, Aug. 1920, pp. 319-322, 10 figs. 8 on supp. plate.

On the State of Carbide in Carbon Steels Quenched and Tempered, Seizô Saitô, Sci. Reports of the Tôhoku Imperial University, vol. 9, no. 4, Aug. 1920, pp. 281-287, 29 figs. on 3 supp. plates.

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Nitrogen, Effect of. Some Notes on the Effect of Nitrogen on Steel, O. A. Knight and H. B. Northrup. Chem. & Metallurgical Eng., vol. 23, no. 23, Dec. 8, 1920, pp. 1107-1111, 8 figs. Experiments showed that at least five definite layers are produced on surface of low-carbon steel when it is exposed to ammonia at 659 deg. cent. Excessive brittleness in outer zones is held responsible in part for gun erosion.

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Sheet, Thermal Conductivity of. Reducing Temperature of Laminated Cores, T. S. Taylor. Elec. World, vol 76, no. 24, Dec 11, 1920, pp. 1159-1162, 3 figs. Experiments at research laboratory of Westinghouse Electric & Manufacturing Co. It was found that transverse thermal conductivity of sheet steel is increased by application of pressure and by varnishing laminations.

Stainless. Stainless Steel, J. H. G. Monypenny. Jl. Soc. Chem. Industry, vol. 39, no. 32, Nov. 30, 1920, pp. 390R-391R. Commercial Utilization of non-corrodible properties of steel containing about 12 per cent chromium.

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Structure. The Structure of Steel, H. T. Belaiew. Aeronautics, vol. 19, no. 360, Nov. 11, 1920, pp. 347-349. Secondary crystallization. (Concluded.) Paper read before Instn. of Aeronautical Engineers.

Vanadium. *See Vanadium Steel.*

STEEL FOUNDING

Cleaning Problems. Steel Foundry Cleaning Problems, A. W. Gregg. Foundry, vol. 48, no. 23, Dec. 1, 1920, pp. 944-945. Methods of flogging, sand-blasting, flame cutting of risers, welding, annealing, sawing risers, chipping, and grinding. Paper read before Am. Foundrymen's Assn.

STEEL, HEAT TREATMENT OF

Electric Furnaces. The Electrical Heat Treatment of Steel, H. P. MacDonald. Trans. Am. Soc. for Steel Treating, vol. 1, no. 3, Dec. 1920, pp. 198-207 and (discussion) pp. 207-208, 12 figs. Records of electric furnace operation.

Quenching Mediums. The Efficiency of Various Quenching Mediums and Their Application, Victor E. Hillman. Trans., Am. Soc. for Steel Treating, vol 1, no. 3, Dec. 1920, pp. 161-166 and (discussion) pp. 166-170, 6 figs. Comparative value of animal, vegetable, mineral and compounded oils.

Relation to Hardening. Relation of the High-Temperature Treatment of High-Speed Steel to Secondary Hardening and Red Hardness, Howard Scott. Sci. Papers, Bur. of Standards, no. 395, Sept. 16, 1920, pp. 521-536, 18 figs.

Tractor Worms. Time, Temperature and Heating Media Functions in Hardening Tractor Worms, J. L. McCloud. Trans. Am. Soc. for Steel Treating, vol. 1, no. 2, Nov. 1920, pp. 116-122 and (discussion) pp. 122-126, 12 figs. Practice of Ford Motor Co.

STEEL INDUSTRY

Germany. Germany's Steel Trade Cautions. Iron Trade Rev., vol. 67, no. 22, Nov. 25, 1920, pp. 1476-1478, 1 fig. Analysis of conditions in German iron and steel industry during third quarter of 1920.

South Russia. The Coal, Iron and Steel Industries of South Russia, Arthur W. Richards. Elecn., vol. 85, no. 2216, Nov. 5, 1920, pp. 539-540. Electrical developments.

STEEL MANUFACTURE

Basic Open-Hearth. Working Galvanized Scrap in the Basic Open-Hearth, R. W. Mueller. Iron Age, vol. 106, no. 23, Dec. 2, 1920, pp. 1509. German installation for working galvanized scrap in basic open-hearth furnace, with simultaneous recovery of zinc as zinc oxide.

Electric Furnace. Electric Steels, C. G. Carlisle. Eng. & Indus. Management, vol. 4, no. 20, Nov. 11, 1920, pp. 618-620. Ability and art of furnaceman in controlling his slags determines whether sound metal is produced or not. Tests show that electric furnace is capable of making excellent nickel-chrome steels; results of series of compression tests are given. Description of an improved exhaust valve.

The Present Position and Prospects of Electric Steel in Great Britain, W. S. Gifford. Elec., vol. 85, no. 2216, Nov. 5, 1920, pp. 528-529, 2 figs. Typical furnace installations.

Ingots. Casting of Steel Ingots, S. W. Williamson. Iron & Coal Trades Rev., vol. 101, no. 2751, Nov. 19, 1920, pp. 679-681, 2 figs. Comparative advantages of four methods—(1) bottom casting, (2) tundish casting, (3) Fawcett-Batty nozzle, and (4) magnesite nozzle. (Abstract.) Paper read before West of Scotland Iron & Steel Inst.

Defects in Steel Originating in the Ingot, Austin B. Wilson. Chem. & Metallurgical Eng., vol. 23, no. 24, Dec. 15, 1920, pp. 1161-1166, 22 figs. Microscopic appearance of breaks and inclusions of non-metals in steel, which defects originate during pouring or solidification. Various deoxidizers and their end products are listed and briefly discussed.

Production Systems. Process and Apparatus for Increasing Production in Steel Manufacture, Adolph A. Rackoff. Blast Furnace & Steel Plant, vol. 8, no. 12, Dec. 1920, pp. 645-651, 7 figs. Difficulties in present open-hearth practice and how they can be overcome with increased production in new process based on better method of pouring steel.

STEEL PLANTS

Canada. New Steel Plant in Western Canada, Commerce Reports, no. 275, Nov. 22, 1920, p. 838. Plant for utilizing scale 40,000 tons of scrap iron formerly exported to United States. Pulverized fuel is used.

France. Messrs. Schneider and Co.'s New Steel Works, Eng., vol 110, no 2863, Nov. 12, 1920, pp. 631-634, 6 figs., partly on 2 supp. plates. Description of works at Breuil near Creusot.

Three-Shift vs. Two-Shift Operation. Three Shifts in the Steel Industry. Iron Age, vol. 106, no. 24, Dec 9, 1920, pp. 1531-1538. Results of investigation covering plants of twenty companies which have adopted eight-hour turn. Questions of increased cost, increased force and increased output. Testimony not uniform on all points, but largely favorable to short day. Paper read at joint meeting of Management and Metropolitan sections of Am. Soc. M. E., New York Section of Am. Inst. Elec. Engrs., and Taylor Society.

Wales. Placnavon Iron and Steel Works. Iron & Coal Trades Rev., vol. 101, no. 2727, Oct. 22, 1920, pp. 541-544, 20 figs. 15 on pp. 557-560. Smelting plant comprises three blast furnaces with total output of 150,000 tons of pig iron per annum. Details of gas-cleaning plant now being installed, of the Halberg-Beth type, consisting of three standard filter boxes, each having a rated capacity of 1,000,000 cu. ft. per hr. measured at 0 deg. cent.; and steel-making plant, consisting of seven Siemen's acid open-hearth gas-fired furnaces, total output capacity being 120,000 tons.

STRESSES

Investigation by Polarized Light. Photo Elasticity for Engineers—I, E. G. Coker. Gen. Elec. Rev., vol. 23, no. 11, Nov. 1920, pp. 870-877, 8 figs. Investigation of stresses by means of polarized light transmitted through models of transparent material under stress. Explanation of principles involved in method and exposition of results obtained in practice.

Legal Aspects. The Law in Regard to Strikes, Chesla C. Sherlock. Am. Mach., vol. 53, nos. 24 and 25, Dec. 9, and 16, 1920, pp. 1087-1089 and 1141-1144. Dec. 9: Necessity for enacting of laws, Federal and State, to govern or fix responsibility for strikes and lockouts. Dec. 16: Legal liabilities, responsibilities and duties imposed on employer by reason of strike at his shop or plant.

STRUCTURAL STEEL

Standard Sections. Specifications for Steel Bars, Blooms, and Billets for Other Purposes than the Manufacture of Tools (Cahier des charges pour la fourniture de barres, blooms, billettes et largets en aciers au carbone autres que les aciers à outils. Revue de Métallurgie, vol. 17, no. 9, Sept. 1920, pp. 619-626, 4 figs. Prepared by Commission Permanente de Standardisation.

STUDS

Eccentric-Headed. Making Eccentric-Headed Studs, Frank S. Ward. Am. Mach., vol. 53, no. 24, Dec. 9, 1920, pp. 1083-1084, 4 figs. Method in English munition plant which undertook large contract during war.

SUBWAYS

Ventilation. Subway Ventilation, Jasper T. Kane. Mun. Engrs. Jl., vol. 6, 1920, pp. 127. 1-127. 14 and (discussion) pp. 127. 15-127. 21. System in New York subways.

T

TEMPERING

Reheating. Tempering and Reheating of Metallergical Products (La Trempe et le reveau des produits métallurgiques), Léon Guillet. Revue générale des Sciences, vol. 31, nos. 17-18 and 19, Sept. 15-30 and Oct. 15, 1920, pp. 564-581, 34 figs. and 618-620, 5 figs. Influence of different methods of reheating on resulting hardness of alloy steels and bronzes. Diagrams and photomicrographs. Theory of tempering.

TERMINALS, MARINE

Mechanical Handling Equipment. Mechanical Handling Equipment as a Means of Reducing Expensive Terminal Costs, G. F. Nicholson. Freight Handling and Terminal Eng., vol. 6, no. 10, Oct. 1920, pp. 377-384. Type of equipment required. Paper read before Pacific Coast Port Authorities Annual Convention.

TIDAL POWER

Severn Barrage Scheme. The Severn Barrage Scheme. Elecn., vol. 85, no. 2220, Dec. 3, 1920, pp. 659-660, 1 fig. Scheme for utilizing over one-half million horsepower of tidal energy. Designs have been worked out by civil engineering department British Ministry of Transport.

Utilization of. Utilization of the Tides (Utilisation des marées), Amiral Amet. Revue générale de l'Electricité, vol. 8, nos. 16 and 17, Oct. 16 and 23, 1920, pp. 531-542, 11 figs. and 565-575, 9 figs. Schemes for utilizing tidal power at Saint-Malo, France.

TILE

Drain. The Flow of Water in Drain Tile, D. L. Yarnell and Sherman M. Woodward. U. S. Dept. Agriculture, bul. 854, Aug. 26, 1920, 50 pp., 13 figs. Experiments on tile four inches in diameter and larger. It was ferified that value of co-efficient roughness in Kutter formula as determined for a pipe at any dept of flow less than full does not apply to that pipe when flowing full. Loss of head was found to be proportional to the 2.0 power of velocity and not 1.8 power as given by many authorities.

Tile Drain Maintenance and Repair on U. S. R. S. Projects. Eng. News-Rec., vol. 85, no. 24, Dec. 9, 1920, pp. 1146-1148. Bedding in gravel and laying on cradles frequently only method of preventing settlement in quicksand. From Reclamation Record.

TIME STUDY

Small-Part Manufacture. Time Study in Small Part Manufacture, Philip Bernstein. Indus. Management, vol. 60, no. 6, Dec. 1920, pp. 401-406. Practical procedure on drilling, profiling, hand and power milling, automatic screw machine and other operations.

TOOLS

Grinding. Grinding Expedites Tool Building, Douglas T. Hamilton. Iron Trade Rev., vol. 67, no. 22, Nov. 25, 1920, pp. 1472-1475, 11 figs. Practice at plant of Fellows Gear Shaper Co., Springfield, Vt.

TRADE UNIONS

Legal Responsibility. Should Trade Unions and Employers' Associations be Made Legally Responsible?, Forest R. Black. Nat. Indus. Conference Board, no. 10, June 1920, 35 pp. It is shown that rules of legal liability in theory apply to unincorporated associations in much the same way as to partnerships or corporations, but that as practical matter it is more difficult for plaintiff to conduct litigation and it is praticularly difficult to reach funds. This state of affairs is undesirable and special legislation to legalize trade unions is suggested, as it is held that ordinary law of corporations cannot well apply to them.

TRANSPORTATION

Progress in. Education and Training in Transport, Tramway & Ry. World, vol. 48, no. 25, Nov. 18, 1920, pp. 277-280. Progress in transportation and modern civilization. Presidential address before Inst. of Transport.

TUNNELS

Concrete Lining. Concrete Lining for Cast Iron Tunnel Shells—III. Public Works, vol. 49, no. 22, Nov. 27, 1920, pp. 511-512, 3 figs. Grouting concrete lining to fill voids under flanges of lining rings, using 60 lb. pressure.

V

VANADIUM STEEL

Analysis. Analysis of Vanadium in Steels (Dosage du vanadium dans les aciers), Emile Jaboulay. Revue de Métallurgie, vol. 17, no. 9, Sept. 1920, pp. 627-629. Method consists in dissolving metal in sulphuric acid and transforming vanadium into vanadic acid by action of potassium permanganate.

VIBRATIONS

Machinery. Vibration, Julius Frith. Eng., vol. 110. no. 2863, Nov. 12, 1920, pp. 657-658, 1 fig. Analytical study of vibration, specially that of crank-shafts, flywheels and alternating-current generators.

W

WAGES

Rates. Should the State Interfere in the Determination of Wage Rates?, Harleight H. Hartman. Nat. Indis. Conference Board, no. 12, Aug. 1920, 158 pp. State interference is said to be expedient because it prevents actual pecuniary loss to employer, employee and public, and because it places industrial disputes upon a basis of substantial justice rather than force.

Reduction. What Are You Doing about Wages? Neil M. Clark. Factory, vol. 25, no. 12, Dec. 15, 1920, pp. 1869-1874. Opinions of manufacturers and leaders of labor unions in regard to advisability of reducing present standard of wages.

Wage-Incentive Systems. The Bases of Emerson Incentive, Harrington Emerson. Indus. Management, vol. 60, no. 6, Dec. 1920, pp. 413-416. Comparison of wage-incentive systems.

Common Labor Responds to Incentives, J. D. Town. Indus. Management, vol. 60, no. 6, Dec. 1920, pp. 422-424. Satisfactory results of introducing bonus system in foundry.

WASTES

Industrial. The Disposal of Trade Wastes, Robert Spurr Weston. Public Works, vol. 49, no. 22, Nov. 27, 1920, pp. 504-506. Summarizes present status of subject from viewpoint of municipal official, illustrating special features by examples of recent practice. Paper read beofre Am. Soc. for Mun. Improvements.

WATER FILTRATION

Rapid. Filter Underdrain, Sand Bed and Wash-Water Experience. Eng. News-Rec., vol. 85, no. 21, Nov. 18, 1920, pp. 984-987, 3 figs. Top-sand scouring devices. Gutter design and relation to wash. Underwater shrinkage of sand beds.

WATER PURIFICATION

Chlorine Gas. Sterlisation of Water by Chlorine Gas, J. Stanley Arthur. Eng., vol. 110, no. 2865, Nov. 26, 1920, pp. 716-721, 16 figs. Portable plants for sterilizing water for army at front. Paper read before Instn. Mech. Engrs.

WATER POWER

Development in U. S. Development of National Water-Power Resources, C. D. Wagoner. Eng. World, vol. 17, no. 6, Dec. 1920, pp. 439-441, 3 figs. Statistics of developed and undeveloped water-power in United States.

France. The Harnessing of the Rhône (L'aménagement du Rhône), J. Tribot-Laspière. Technique Moderne, vol. 12, no. 4, April 1920, pp. 151-154, 1 fig. Details of project adopted by French Chamber of Deputies, and its economical advantages.

Great Britain. Water-Power Resources and Projects in United Kingdom, Robert P. Skinner. Commerce Reports, no. 287, Dec. 7, 1920, pp. 1051-1053. Water-power resources committee of British Board of Trade recommends that controlling water commission be established by act of Parliament.

St. John River, Canada. Storage and Power Posibilities on St. John River, A. Langlois. Contract Rec., vol. 34, no. 49, Dec. 8, 1920, pp. 1169-1170, 1 fig. Regulation of flow at reversible falls to improve navigation and permit development of power.

WEIRS

Submerged. Ice Diversion for St. Lawrence Rive Power Co., Benjamin F. Groat. Can. Engr., vol. 39, no. 22, Nov. 25, 1920, pp. 545-552, 10 figs. Construction of submerged weirs and ice-division works in South Sault Channel of St. Lawrence River. Design by hydraulic models. Surface transportivity. Movement on stream beds. Results of operation for two winters.

WELDING

Electric. *See Electric Welding.*

Oxy-Acetylene. *See Oxy-Acetylene Welding.*

WELDS

Testing. Study of the Testing of Welds, S. W. Miller. Blast Furnace & Steel Plant, vol. 8, no. 12, Dec. 1920, pp. 678-683, 26 figs. Bend test. Microscopic and macroscopic study of welds. Paper read beofre Am. Welding Soc.

The Testing of Welds in Steel Plants, S. W. Miller. Ry. Mech. Engr., vol. 94, no. 12, Dec. 1920, pp. 792-794, 9 figs. Conditions which affect quality of welds; simple bend test and etching of sections recommended. Paper read before Am. Welding Soc.

WELFARE WORK

Restaurants. A Centralized Organization for Feeding Men, Hunter McDonald. Ry. Maintenance Engr., vol. 16, no. 12, Dec. 1920, pp. 469-472, 11 figs. Plan in use by Nashville, Chattanooga & St. Louis Railway. Paper read before Am. Ry. Bridge & Building Assn.

Solves Problem of Feeding Army of Workers. Iron Age, vol. 106, no. 24, Dec. 1920, pp. 1527-1530, 9 figs. Dining room at East Pittsburgh works of Westinghouse Electric & Mfg. Co., where 50,000 persons are employed.

Savings Association. Our Savings Association as an Aid to Management, C. L. Walker. Factory, vol. 25, no. 11, Dec. 1, 1920, pp. 1715-1718, 5 figs. Experience of A. W. Shaw Co.

Savings Plan. How One Community Has Succeeded in Getting Employees to Save. John F. Tinsley. Factory, vol. 25, no. 12, Dec. 15, 1920, pp. 1899-1901, 4 figs. Plan employed at Worcester Works in Massachusetts.

Sick Leave With Pay. A Plan for Sick Leave With Pay, Morris R. Machol. Indus. Management, vol. 60, no. 6, Dec. 1920, pp. 453-454. Method is based on length of time employee has been in service of company.

WHEELS

Cast-Iron, Grinding. Grinding Cast Iron Wheels, Ry. and Locomotive Eng., vol. 33, no. 12, Dec. 1920, pp. 345-349, 2 figs. Machine for grinding wheels. Tables showing data of measurements of slid flat wheels.

WIRE MANUFACTURE

Processes. Modern Process of Drawing Wire, L. Dwight Granger. Blast Furnace & Steel Plant, vol. 8, no. 12, Dec. 1920, pp. 661-663. Practical application surrounded by great many technical considerations with reference to speed of wire through dies. Annealing and composition of material.

WOMEN WORKERS

Advisability. The New Place of Women in Industry—III, Ida M. Tarbell. Indus. Management, vol. 60, no. 6, Dec. 1920, pp. 399-400. Management of women workers.

WORKMEN'S COMPENSATION

Acts. Your Liability for Concurrent Compensation, Chesla C. Sherlock. Am. Mach., vol. 53, no. 22, Nov. 25, 1920, pp. 998-1000. Provisions of Workmen's Compensation Acts.

Engineering Index

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A

ABRASIVE WHEELS

100,000 r.p.m. Grinding-Wheel Spindle Operated at an Unusual Speed. Machy (N.Y.), vol. 27, no. 5, Jan. 1921 p. 420, 2 figs. Spindle manufactured by A. A. Jones & Shipman Co., Ltd., Leicester, England, and designed to be operated at speed of 104,000 r.p.m. Drive is through intermediate shaft and special rubber belts are used. Spindle, which is in experimental stage, was shown at machine-tool exhibition recently held in London.

ACCIDENT PREVENTION

Foundry. Safe Shoes Reduce Hot-Metal Burns. Foundry, vol. 49, no. 2, Jan. 15, 1921, pp. 51-53, 5 figs. One-sixth of total foundry accidents are ascribed to defective and unsafe foot-wear. Foot injuries are reduced by proper shoes.

ACCIDENTS

Dust Explosions. Causes and Prevention of Dust Explosions. Colliery Guardian, vol. 120, no. 3128, Dec. 10, 1920, pp. 1677-1678, 1 fig. Account of German experiments. Translated from Zeitschrift für Berg-Hütten- und Salinenwesen.

Engineering Problems in Dust Explosion Prevention, David J. Price. Chem. & Metallurgical Eng., vol. 24, No. 1, Jan. 5, 1921, pp. 29-32, 5 figs. Notes on causes and factors effecting dust explosions. Types of industrial plants affected. Ignition temperatures, propagation and velocity of flame, pressures developed and relation of humidity and prevention of explosions.

The Prevention of Dust Explosions, Hylton R. Brown. Am. Industries, vol. 21, no. 6, Jan. 1921, pp. 27-29, 2 figs. Tests at Bureau of Chemistry, U.S. Dept. of Agriculture.

Eyes Injuries. Factory Eye Room Saves Workers' Sight and Increases Output, Sanford DeHart. Indus. Management, vol. 61, no. 1, Jan. 1, 1921, pp. 23-24, 1 fig. Experience of R. K. LeBlond Machine Tool Co.

The Economic Aspect of Eye Injuries, T. Lister Llewellyn. Colliery Guardian, vol. 120, no. 3129, Dec. 17, 1920, p. 1749. Analysis of total accident claims made at a number of British coal and iron mines.

AEROPLANE PROPELLERS

Design. The Metal Airscrew, M. A. S. Riach. Aeronautics, vol. 19, no. 375, Dec. 23, 1920, pp. 450 and 459, 2 figs. Metal versus wood for aeroplane propellers.

Gear Drive. Experience with Geared Propeller Drives for Aviation Engines, K. Kutzbach. Aerial Age, vol. 12, nos. 17 and 18, Jan. 3 and 10, 1921, pp. 442-445, 9 figs., and 466-469, 18 figs. Stresses in gear wheels; table of gears from captured engines; arrangements of gear. Translated from Technische Berichte.

AEROPLANES

Design. Aeroplane Design, F. S. Barnwell. Aeronautics, vol. 19, no 376, Dec. 30, 1920, pp 466-467, 1 fig. Present tendencies and future possibilities. (To be continued)

Structural Analysis and Design of Aeroplanes, B C Boulton and A. S. Niles. Aerial Age, vol. 12, no 18, Jan. 10, 1921, pp. 469-470. Review of book by B C. Boulton in charge of stress analysis and structural design, McCook Field.

Helicopters. *See Helicopters.*

Large, Possibilities of. The Possibilities of the Large Airplane, F. H Norton. Aviation, vol. 10, no. 2, Jan. 10, 1921, pp. 48-50, 10 figs. Structural and aerodynamic problems of large aeroplane.

Longitudinal Stability. Statical Longitudinal Stability of Airplanes, Edward P. Warner. Nat. Advisory Committee for Aeronautics, report no. 96, 1920, 28 pp., 14 figs. Results of experimental work, together with details of theoretical analysis of statical stability, of factors which affect it, and of methods which can be employed for its modification.

Model Tests. Value of Model Tests, J. W. Margoulis. Aviation, vol. 10, no. 2, Jan. 10, 1921, pp. 40-42, 1 fig. Influence of ratio of dimensions of model and speed of test to dimensions of full scale machine and its speed of flight.

Single-vs.-Twin-Engined. A Comparison of the Flying Qualities of Single and Twin-Engined Aeroplanes. Aeronautical Jl., vol. 21. no. 120, Dec. 1920, pp. 616-627. Factors in design which are most vital to pilot and how they influence his handling of aeroplane.

Stability. Diagrams of Airplane Stability, H. Bateman. Nat. Advisory Committee for Aeronautics, report no. 95, 1920, 25 pp., 28 figs. Effect on period and rate of subsidence of pitching oscillations of an airplane of a change in one of resistance derivatives when all others are kept constant.

Wind Tunnels. *See Wind Tunnels.*

Wings. Slotted Airplane Wings. Sci. Am. Monthly, vol. 3. no. 1, Jan. 1921, pp. 66-67, 2 figs. Handley-Page wings of Venetian blind form.

AIR

Dust-Content Determination. Efficiency of the Palmer Apparatus for Determining Dust in Air, S. H. Katz, E. S. Longfellow and A. C. Fieldner. Jl. Am. Soc. Heat. and Vent. Engrs., vol. 26, no. 8, Nov. 1920, pp. 687-700, 5 figs. Two methods of testing were used. In first efficiency was determined on basis of surface of particles entering apparatus as compared with surface leaving, by use of Tyndall effect. Second method was based on weight of dust, and used small laboratory Cottrell precipitator in series with Palmer washer.

AIR COMPRESSORS

High-Pressure. High-Pressure Air and Gas Compressors. Eng., vol. 110, no. 2869, Dec. 24, 1920. pp. 829-831, 3 figs. Six-Stage 4500-lb. per sq. in. compressor built to order of British admiralty for naval experimental station described in second installment.

Manufacture. Building Air Compressors. Eng. Production, vol. 2, no. 14, Jan. 6, 1921, pp. 7-12, 14 figs. Manufacturing methods in plant of Reavell & Co., Ipswich, England.

AIR CONDITIONING

Humidifier. Physiological Heat Regulation and the Problem of Humidity, E. P. Lyon. Jl. Am. Soc. Heat. and Vent. Engrs., vol. 26, no. 8, Nov. 1920, pp. 677-685. Importance of using humidifier in connection with heating system in houses and factories.

AIRSHIPS

Mooring. Airship Mooring and Handling, F. L. C. Butcher. Aeronautics, vol. 19, no. 374, Dec. 16, 1920, pp. 432-435. Advantages and disadvantages of windscreens. Experiments with drogues. Paper read before Royal Aeronautical Soc.

Piloting. Airship Piloting, G. H. Scott. Flight, vol, 12, no. 50, Dec. 9, 1920, pp. 1254-1258. Difficulties encountered in airship piloting and methods employed to overcome these difficulties. Paper read before Royal Aeronautical Society.

Rigid. Operation of a Rigid Airship, L. H. Maxfield. Aviation, vol. 10, no. 1, Jan. 3, 1921, pp. 15-16. Duties of airship crew.

ALCOHOL

See Automobile Fuels, Alcohol.

ALUMINUM

Casting. Analyse Loss in Aluminum Shops—II, Robert J. Anderson. Foundry, vol. 49, no. 1, Jan. 1, 1921, pp. 16-21. Effect on casting losses of stock used in melting charge and also of pouring temperature and melting practice, including type of furnace used.

Soldering of. The Practicability of Soldering Aluminum, A. N. Fleming. Sheet Metal Worker, vol. 11, no. 15, Dec. 24, 1920, pp. 427 and 433, 1 fig. How aluminum transmission case was repaired by soldering.

ALUMINUM ALLOYS

Magnesium. The Constitution of the Alloys of Aluminum and Magnesium, D. Hanson and Marie L. V. Gayler. Eng., vol. 110, nos. 2867-2868, Dec. 10-17, 1920, pp. 788-791, and 17 figs., 819-821, 18 figs. Research carried out in Metallurgy Department of National Physical Laboratory, England. Determination of solidus. Photomicrographs. Abstract of paper read before Inst. Metals.

AMMONIA

Properties. Properties of Ammonia. Refrigerating World, vol. 55, no. 12, Dec. 1920, pp. 21-28. Tables prepared by National Bureau of Standards with co-operation of American Society of Refrigerating Engineers.

AMMONIA COMPRESSORS

Development. The Development of the Modern High Efficiency Ammonia Compressor Through the Application of the Worthington Feather Valve, Thos. D. McKee. Ice & Refrigeration, vol. 60, no. 1, Jan. 1921, pp. 13-15. Advantages of high speed ammonia compressors.

APPRENTICES, TRAINING OF

Machinists. Training Operators in a Machine Shop, John C. Spence. Machy. (N.Y.), vol. 27, no. 5, Jan. 1921, pp. 421-423, 2 figs. Methods employed in plant of Norton Co., Worcester, Mass., in training of machine-shop workers.

Training the Machinist of the Future, J. H. Moore. Can. Machy., vol. 25, no. 2, Jan 13, 1921, pp. 33-38, 12 figs. Organization and operation of Hamilton Technical & Art School.

Railroad Shop. A Railroad Shop's Apprentice School, J V. Hunter. Am. Mach., vol. 54, no. 3, Jan. 20, 1921, pp. 97-98, 1 fig. Training school in Decatur locomotive and car shops of Wabash Railway Co. Current expenses defrayed by assessing apprentices. Regular and helper courses given.

ASPHALT

Specifications. Specifications for Asphalt Paving. Mun. and County Eng., vol. 59, no. 6, Dec. 1920, pp. 196-197. Prepared by Technical Committee of Asphalt Association.

AUTOMOBILE ENGINES

Carburetors. *See Carburetors.*

Connecting Rods. Making Connecting-Rods for Franklin Cars, Franklin D. Jones. Machy. (N.Y.), vol. 27, no. 5, Jan. 1921, pp. 470-474, 11 figs. Machines and fixtures used at plant of H. H. Franklin Mfg. Co., Syracuse, N.Y., for drilling, boring, milling, grinding, reaming and gaging operations.

Cylinders. *See Cylinders, Manufacture.*

Design. Possible Fuel Savings in Automotive Engines, H. C. Dickinson and S. W. Sparrow. Jl. Soc. Automotive Engrs., vol. 8, no. 1, Jan. 1921, pp. 3-9, 14 figs. Notes on design of manifold and chemical operation of automotive engines. Paper read before Am. Petroleum Inst.

Gasoline Losses. Gasoline Losses Due to Incomplete Combustion in Motor Vehicles, A. C. Fieldner, A. A. Straub and G. W. Jones. Jl. Indus. & Eng. Chem., vol. 13, no. 1, Jan. 1921, pp. 51-58, 7 figs. Results of tests under spring and summer conditions.

New York Show. Engines Exhibited at New York Show, P. M. Heldt. Automotive Industries, vol. 44, no. 2, Jan. 13, 1921, pp. 53-58, 15 figs. Survey of exhibits.

Suspension. A New Principle of Engine Suspension, S. E. Slocum. Jl. Soc. Automotive Engrs., vol. 8, no. 1, Jan. 1921, pp. 54-56, 1 fig. Suspension on three points so as to destroy synchronism between oscillating machine and support so far as transmission of vibrations is concerned.

AUTOMOBILE FUELS

Alcohol. Significance of Alcohol in the Motor Fuel Problem, Burnell R. Tunison. Automotive Industries, vol. 44, no. 1, Jan. 6, 1921, pp. 14-17, 5 figs. Advantages of and need for using synthetic fuel containing alcohol. Data regarding performance of engines using alcohol.

Benzol. The Manufacture of Motor Spirit in Gas-works. Gas World, vol. 73, no. 1900, Dec. 18, 1920, pp. 493-494. Stripping process of benzol recovery and its financial results.

Gasoline. *See Gasoline.*

AUTOMOBILES

Body Suspension. Study of Suspension on Automobile Bodies and of Shock Absorbers (Étude sur la suspension des véhicules et les amortisseurs), G. Puica. Vie Technique & Industrielle, vol. 2, no. 14, Nov. 1920, pp. 117-120, 4 figs. Formula for designing springs. Study of stresses in spring plates.

Design. European Automobile Design for 1921. Sci. Am., vol. 124, no. 1, Jan. 1, 1921, pp. 9 and 19-20. Comparison of European and American Practices.

Headlights. Report of the Committee on Automobile Headlighting Specifications. Trans. Illuminating Eng. Soc., vol. 15, no. 9, Dec. 30, 1910, pp. 848-866. Recommended practice in headlamp illumination.

Manufacture. More Power for Automobile Building. Power Plant Eng., vol. 25, no. 2, Jan. 15, 1921, pp. 101-110, 17 figs. New plant of Cadillac Motor Car Co., Detroit, Mich.

Metal Construction. Substitute Metals in Automobile Construction, Benno R. Dierfeld. Automotive Industries, vol. 43, no. 27, Dec. 30, 1920, p. 1309. How copper and aluminum were substituted for iron and steel in Germany during war.

Rear-Axle Housings. Machining Columbia Rear-Axle Housings, Fred H. Colvin. Am. Mach., vol. 54, no. 1, Jan. 6, 1921, pp. 27-30, 15 figs. Operations on drilling, boring, reaming, tapping machines. Press work assembling and testing.

Sheet Metal Work. Sheet Metal Work for Automobiles, Fred H. Colvin. Am. Mach., vol. 53, no. 26, Dec. 23, 1920, pp. 1165-1168, 16 figs. Machinery for stamping and cutting up strips into various lengths and also preparing material for presses.

Transmissions. Clutches, Transmissions and Universal Joints, Herbert Chase. Automotive Industries, vol. 44, no. 2, Jan. 13, 1921, pp. 79-81, 4 figs. Trend of design as revealed at New York Show.

AVIATION

Commercial. Commercial Aircraft, B. W. Townshend. Aeronautics, vol. 19, no. 373, Dec. 9, 1920, pp. 421-423, 1 fig. Position of airships and aeroplanes in future of aerial transport. Paper read before City and Guilds Engineering Society.

Commercial Aviation in Great Britain (La navigation commerciale aérienne en Grande-Bretagne)—I. Génie Civil, vol. 77, no. 23, Dec. 4, 1920, pp. 456-460, 1 fig. Models submitted for air ministry competition held in September 1920. (To be continued.)

Developments. Recent Advances in Aviation, Thurman H. Bane. Jl. Soc. Automotive Engrs., vol. 8, no. 1, Jan. 1921, pp. 18-25, 26 figs. Aeroplanes and aeroplane engines developed during war.

Nationality Marks. International Aircraft Marking, Ladislas d'Orey. Aviation, vol 9, no. 15, Dec. 27, 1920, pp. 484-486, 3 figs. Nationality and registration marks for aircraft. Proposed table of nationality marks.

Night Flying. Night Flying. Aeronautical Jl., vol. 24, no. 120, Dec. 1920, pp. 627-642 and (discussion) pp. 643-649. Experience during war. Best type of machine for night flying.

See also Flight.

AVIATORS

Fatigue of. The Human Machine in Relation to Flying. Aeronautical Jl., vol. 24, no. 120, Dec. 1920, pp. 650-658 and (discussion) pp. 658-663. Reasons why pilots should have periodic intervals of rest. International convention fixed period of six months for civilian pilot.

Tests of. Observation, Selection, and Assignment. Air Service Information Circular, vol. 2, no. 120, Oct. 30, 1920, 8 pp. Qualities needed by aviators. Process of selection from application.

B

BALANCING MACHINES

Rotors, High-Speed. Rotor Balancing Machine. Eng., vol. 110. no. 2866, Dec. 3, 1920, pp. 737-738, 2 figs. Machine devised by N. W. Akimoff for testing both static and dynamic balance of high-speed rotors.

BEAMS

Vibrations Form Shafting. *See Shafts, Whirling Speeds.*

BEARINGS

Manufacture. Modern Bearings (Les paliers modernes). Nature (Paris), no. 2428, Oct. 16, 1920, pp. 243-246, 2 figs. Developments in manufacture, with reference to type developed by Brown Boveri Co.

Self-Lubricating. Self-Lubricating Bearings. Iron Age, vol. 107. no. 2, Jan. 13, 1921, p. 146. Reliance type consisting of inner and outer casings joined by force fit. Tapered holes in inner casing are filled with lubricating mixture under pressure.

Testing. Testing Hardness of Bearings and Journal. Iron Age, vol. 106, no. 27, Dec. 30, 1920, pp. 1727-1730, 16 figs. Progress report of subcommittee on bearing metals of The American Society of Mechanical Engineers. Description of tentative scale of so-called microhardness that expresses in definite units relation of hardness between different materials.

BELTING

Balata. The Manufacture of Balata Belting. India Rubber World, vol. 63, no. 4, Jan. 1, 1921, pp. 236-238, 16 figs. Translated from Le Caoutchouc et la Gutta Percha.

Leather. A New Type of Leather Belt. Eng., vol. 130, no. 3380, Dec. 10, 1920, pp. 590, 2 figs. Patented by French inventor. Belt consists of backing 3 in. by ¼ in. oak-tanned leather to underside of which are riveted three strips of chrome leather, each strip being about 3-16 in. wide by 5-32 in. thick. Attachment in strips to backing is effected by means of brass rivets pitched at 2 in. intervals.

Effect of Relative Humidity on Leather Belting, F. W. Roys. Belting, vol. 18, no. 1, Jan. 1921, pp. 40-48, 9 figs. Also Textile World Jl. vol. 59, no. 2, Jan. 8, 1921, pp. 93-97, 9 figs. Tests at Worcester Polytechnic Institute. With adjustments of regular oak belts at 55 per cent humidity, no change was found to either tighten or slacken belt so as to cause trouble.

BLAST-FURNACE GAS

Purification. Purification of Blast Furnace Gas (État actuel de l'épuration des gas de hauts-fourneaux), M. Alexandre Gouvy. Revue de Métallurgie, vol. 17, no. 10, Oct. 1920, pp. 677-686, 7 figs. Description of Cottrell process using electricity at high tension.

BLAST FURNACES

Coke Efficiency. Blast Furnace Problems of Today, C. E. Roberts. Eng. & Indus. Management, vol. 5, no. 1, Jan. 6, 1921, pp. 7-10. Coke efficiency, increase in moisture content, dust difficulty, scientific control of furnace working. Paper read before Staffordshire Iron & Steel Inst.

Operation, Chile. Green Wood in the Blast Furnace, François Prudhomme. Iron Age, vol. 107, no. 2, Jan. 13, 1921, pp. 121-122. Making pig iron of tofo ores at Corral, Chile. Wood charred in upper part of furnace and distillates recovered. Chilean Government report.

Reducing Reactions. Reducing Reactions in the Blast Furnace (Des réactions réductrices dans le haut fourneau), Em. Pierre. Revue universelle des mines, vol. 7, no. 5, Dec. 1, 1920, pp. 301-321, 5 figs. Researches showed that reaction by CO is best for reducing FeO. Studies of action of gas on minerals.

Slags. Sampling Blast Furnace Slags, W. M. Chegwidden. Iron Trade Rev., vol. 67, no. 26, Dec. 23, 1920, pp. 1750-1751. Relation of sulphur in slag to sulphur in pig iron.

BOILER FEEDWATER

Heating, Economic Advantages of. Exhaust Wastes. Power Plant Eng., vol. 25, no. 1, Jan. 1, 1921, pp. 72-74, 2 figs. Chart showing percentage of fuel saved by heating feedwater by exhaust steam.

BOILER FURNACES

See Furnaces, Boiler.

BOILER ROOMS

Design. Design of Large Boiler Plants, J. Grady Bollow. Jl. Am. Soc. Heat. and Vent. Engrs., vol. 26, no. 8, Nov. 1920, pp. 715-734, 10 figs. Typical double-wall boiler plant with furnace for burning coal and dry wood waste.

Economical Operation. Reducing Operating Costs in Noiler Rooms, John Rusen. Coal Industry, vol. 4, no. 1, Jan. 1921, pp. 14-18, 8 figs. Advises mechanical conveying for coal and ashes will materially reduce costs.

Remodeling. Remodeling Old Power, Stations—Boiler-Plant Improvements, L. R. Lee. Power, vol. 52, no. 26, Dec. 28, 1920, pp. 1004-1007, 1 fig. Economical methods of increasing capacity of boiler plants.

BOILERS

Electrically Heated. Bergeon-Frédet Electrically Heated Steam Boiler (Le générateur de vapeur "Bergeon-Fredet" à chauffage électrique). Chaleur et Industrie, no. 7, Oct. 1920, pp. 403-405, 3 figs. Horizontal cylindrical type boiler heated by three-phase current of 50 periods under tension of 6300 volts.

Electrically Heated Boilers. Elec. Times, vol. 58, no. 1523, Dec. 23, 1920, p. 491, 2 figs. Boilers manufactured by Sulzer Bros., London.

Manhole Cutting. Ellipsograph for Manhole Cutting. Eng., vol. 110, no. 2868, Dec. 17, 1920, p. 817, 3 figs. Patented device.

Marine. *See Marine Boilers.*

Massachusetts Board Boiler Rules. Change in Massachusetts Boiler Rules. Power Plant Eng., vol. 25, no. 2, Jan. 15, 1921. pp. 121-122. Changes adopted at public hearing held by Board of Boiler Rules.

Performance. Exact Data on the Performance of Steam Boiler Plants—IV, David Brownlie. Eng., vol 110, nos. 2867-2868, Dec. 10-17, 1920, pp. 759-761 and 797-799. Average figures for performance of a number of different types of steam boilers.

Tubes. Influence of Expanding of Tubes on the Deformation of Tube Sheets of Locomotive Boilers (Influence du sertissage des tubes dans les déformations des plaques tubulaires de foyer des chaudières locomotives), M. Haffner. Revue générale des Chemins de Fer, vol. 39, no. 4, Oct. 1920, pp. 133-138, 5 figs. Comparison of various methods of expanding.

BOILERS, WATER TUBE

Connelly. Connelly Water-Tube Boilers. Can. Manufacturer, vol. 41, no. 1, Jan. 1921, pp. 76-77, 2 figs. Boilers of large capacity built for working pressure of 300 tons per sq. in.

BORING MACHINES

Taper-Turning Head. New Taper-Turning Head for Vertical Boring Mills. Engr., vol. 130, no. 3385, Nov. 12, 1920, p. 485, 5 figs. Attachment manufactured by George Richards & Co., Ltd., Broadhead, England.

BRAKES

Street-Car. A New Tramcar Brake. Engr., vol. 130, no. 3391, Dec. 24, 1920, pp. 642-643, 4 figs. Spencer-Dawson brake.

The Force Action of Brake Riggings, II. M. P. Murphy. Elec. Ry. Jl., vol. 57, no. 3, Jan. 15, 1921, pp. 116-119, 11 figs. Forms of levers used in brake rigging of electric cars. Study of forces acting at various points of levers.

BRIDGES

Design. Calculation of Single-Span Circular Bridges with Two Stay Bolts and Transverse Bracings at the Supports Only (Calcul des ponts circulaires, à une seule travée, comportant deux contreventements et des entretoisements transversaux sur leurs appuis seulement), Bertrand de Fontviolant. Comptes rendus des Séances de l'Académie des Sciences, vol. 171, no. 23, Dec 6, 1920, pp. 1122-1124. Design formulae.

Secondary Stresses. Secondary Stresses in Kenova Bridge Measured, John I. Parcel and George A. Maney. Eng. News-Rec., vol. 85, no. 24, Dec. 9, 1920, pp. 1116-1119, 10 figs. Tests to determine secondaries at four joints under moving coal trains give satisfactory check with calculated results. Effect of load variation and floor stiffness.

BRIDGES, HIGHWAY

Floors. Bituminous Surfacing for Plank Highway Bridge Floors, M. W. Torkelson. Eng. News-Rec., vol. 85, no. 27, Dec. 30, 1920, pp. 1279-1280, 1 fig. Practice of Wisconsin Highway Commission.

BRIDGES, RAILWAY

Reinforced-Concrete. On the Question of Reinforced Concrete (Subject IV for Discussion at the Ninth Congress of the International Railway Association), C. H. Cartlidge. Bul Int. Ry. Assn., vol. 2. no. 12 Dec. 1920, pp. 815-877, 54 figs. Typical designs of railway bridges.

BUILDING CONSTRUCTION

Framework. Rules for the Construction of Metal Frame-Work (Règlements pour la construction des charpentes métalliques). Revue universelle des mines, vol. 7, no. 3, Nov. 1, 1920, pp. 151-226, 2 figs. Rules govern selection of materials, number and placing of rivets, mounting procedure, and stresses to be assumed for wind and snow loads on walls and roofs. Rules were formulated by Association belge de Standardisation.

Office Building. The Metropolitan Annex, New York City, D. Everett Waid. Am. Architect, vol. 118, no. 2348, Dec. 22, 1920, pp. 827-836, 18 figs. Structural details of 48-story building.

BUSES

Trolley-Operated. Trackless Trolley in Two British Cities. Elec. Ry. Jl., vol. 57, no. 2, Jan. 8, 1921, pp. 77-79, 5 figs. Bradford, with three routes in operation, is planning three more. Buses are used as feeders for trolley system. Double-deck trackless-trolley bus has just been put in service. Keighley, after five years' experience, has added to its equipment, and now has nine buses in service.

C

CABLES, ELECTRIC

Heating of. Research on the Heating of Buried Cables. Elecn., vol. 85, no. 2223, Dec. 24, 1920, pp. 738-740, 7 figs. Tests at Liverpool University on vulcanized bitumen cables laid solid in stoneware throughing, also report of work at Newcastle-upon-Tyne on extra high-pressure paper-insulated cables laid direct in ground at different depths.

Protection Against Electrolysis. Protection of Cables Against Electrolysis. Ry. Signal Engr., vol. 13, no. 12, Dec. 1920, pp. 527-532, 1 fig. Methods employed for detecting electrolysis action and means to be employed for its elimination or mitigation. Report presented to Telegraph and Telephone Section, Am. Ry. Assn.

Steel Cores. The Electrical Characteristics of Transmission Conductors with Steel Cores, H. B. Dwight. Elec. Jl., vol. 18, no. 1, Jan. 1921, pp. 9-10, 1 fig. Formula for computing effect of steel core on electrical characteristics of cable.

Submarine. The Impedance of Submarine Cables, Douglas C. Gall. Elecn., vol. 85, no. 2223, Dec. 24, 1920, pp. 736-738, 5 figs. Tests on cables having different characteristics.

Underground. Some Distribution Cable Experiences, T. H. Arnold. Power, vol. 52, no. 26, Dec. 28, 1920, pp. 1021-1022. Industrial-plant load may increase to where underground cables are dangerously over loaded without it being realized. In one case temperatures were so high that duct walls were softened. Method of cleaning out duct described.

CABLEWAYS

Design. Didactic Study of Aerial Cableways (Étude didactique des transporteurs aériens sur cables), Gaulio Ceretti. Génie Civil, vol. 77, no. 22, Nov. 27, 1920, pp. 430-435, 12 figs. Details of design of cable junctions and suspension methods. (Concluded.)

CANALS

Electric Haulage of Barges. New Systems of Electric Haulage in Canals (Nouveaux systèmes de halage électrique sur les canaux), Edouard Imbeaux. Comptes rendus des Séances de l'Académie des Sciences, vol. 171, no. 21, Nov. 22, 1920, pp. 981-985. Recent developments in France.

CARBURATION

Theory of. Contribution to the Problem of Carburation (Contribution au "sujet" de la carburation), A. Grebel. Chaleur & Industrie, no. 8, Nov.-Dec. 1920, pp. 455-473, 15 figs. Technical study of principles upon which carburation is based and of their application to the carburation of gasoline engines and gas engines together with investigation of chemical practicability of utilizing gas as fuel in automobile engines.

CARBURETORS

Claudel. New Carburetor Construction Types (Neue Vergaser-Konstruktionen), H. Praetorius. Motorwagen, vol. 23, no. 30, Oct. 31, 1920, pp. 572-578, 12 figs. Details of the three types of Claudel automobile carburetors, the Eureka, Craetzin, Lacharnay, Standard, Einhorn and Asmo carburetors.

Einhorn. The Einhorn Carburetor (Der Einhorn-Vergaser), Johannes Menzel. Allgemeine Automobil-Zeitung, vol. 21, no. 41, Oct. 9, 1920, pp. 26-28, 2 figs. Describes automatically adjustable carburetor for use of heavy fuels of all kinds, which won first prize at tests carried out by Gen. German Automobile Club in conjunction with Automotive Testing Commission.

Floatless. Floatless Carburetors Coming Into Use in Germany, Benno R. Dierfeld. Automotive Industries, vol. 43, no. 26, Dec. 23, 1920, pp. 1262-1265, 11 figs. Developments in carburetor design in Germany.

CARS

Ball Bearings for. Ball Bearings for Railway Cars. Ry. Mech. Engr., vol. 95, no. 1, Jan. 1921, pp. 23-24, 5 figs. Graphs of train resistance with journal bearings and with disk bearings.

Diesel-Electric Self-Propelled. Diesel-Electric Self-Propelled Railway Coaches. Engr., vol. 130, no. P3386, Nov. 19, 1920, p. 511. Swedish design. Translated from Génie Civil.

CASE-HARDENING

Furnace for. A New Method of Case-Hardening Steel, Wm. J. Merten. Am. Mach., vol. 53, no. 26, Dec. 23, 1920, pp. 1169-1170, 1 fig. Regenerative type of furnace.

CASTINGS

Die. Die Castings, W. Betterton. Metal Industry (London), vol. 17, no. 24, Dec. 10, 1920, pp. 461-464, 8 figs. Manufacture of castings are accurately cast to limit of one-thousandth of an inch so that no machining is necessary. Alloys from which such castings can be made are discussed and advantages of die casting are pointed out.

Inspection. Precise Inspection of Large and Irregular Curves, Elbert O. Brower. Am. Mach., vol. 54, no. 2, Jan. 13, 1921, pp. 60-66, 13 figs. Method for inspection of large and irregular curves, and its application to inspection of castings.

Iron. *See Iron Castings.*

Malleable. Shop Specializes in Annealing Pots. Foundry, vol. 49, no. 1, Jan. 1, 1921, pp. 11-15, 7 figs. Manufacture of malleable castings on production basis.

Steel. *See Steel Castings.*

CEMENT

Setting Time. Modified Vicat Apparatus for Study of Setting Time of Cement, O. L. Moore. Eng. News-Rec., vol. 86, no. 2, Jan. 13, 1921, p. 70, 3 figs. Principle consists in balancing rod and needle by means of beam and weight and determining load necessary at time intervals to cause needle to penetrate definite distance into neat paste.

CEMENT, PORTLAND

Consolidation. Judging the Quality of Portland Cement, R. J. Colony. Min. & Metallurgy, no. 169, Jan. 1921, pp. 30-31, 1 fig. Triangular concentration diagram showing end products of consolidation. (Abstract.)

Specifications. British Standard Specification for Portland Cement. Eng. World, vol. 18, no. 1, Jan. 1921, pp. 5-8, 4 figs. Specifications of British Standards Engineering Association revised in 1920.

Wet Process. Development in Wet Process Portland Cement Plants—II. Rock Products, vol. 24, no. 2, Jan. 15, 1921, pp. 39-44, 12 figs. Description of process at plant of Bessemer Limestone & Cement Co., Bessemer, Pa., from kilns to finished product.

CENTRAL STATIONS

Isolated Plants vs. Power Development in the Future, Lazarovich-Hrebellianovich. Power, vol. 52, no. 19, Nov. 9, 1920, pp. 744-747. Comparative study of central stations and isolated plants.

Mineside. Modern Central Power Station in Center of a Coal Mining District, F. G. Hickling. Coal Industry, vol. 4, no. 1, Jan 1921, pp. 24-27, 7 figs. Riversville Central Station of Monogahela Valley Traction Co., Fairmount, W.Va. Two 12,500-kva. turbine generator units have been installed and additional 25,000 kva. unit has been ordered.

Operation in U. S. Output for 1920 Estimated at 46,700,000,000 Kw-Hr. Elec. World, vol. 77, no. 1, Jan. 1, 1921, pp. 45-46, 2 figs. Statistics of central station operations in United States.

CHIMNEYS

Brick. Radial Brick Chimneys, W. F. Leggo. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 26, no. 9, Dec. 1920, pp. 795-808, 12 figs. Details of construction of various types. Tables giving sizes of chimneys required for various horsepower capacities.

Steel, Copper-Smelter. Steel Chimneys and Their Linings in Copper Smelting Plants, A. G. McGregor. Min. & Metallurgy, no. 167, Nov. 1920, p. 34. It is concluded from experiments at various plants that unlined steel chimneys do not give satisfactory service when used for roaster furnaces or reverberatory furnaces, but they will prove serviceable for long periods when used for blast furnace and converter gases. Building tile has proved unsatisfactory for chimney linings or for construction of walls for flues and dust chambers where exposed to roaster furnace gases or cool reverberatory furnace gases. (Abstract.)

CITY PLANNING

Street Width. Width of Roadways for Different Classes of Streets, Robert Hoffmann. Mun. and County Eng., vol. 59, no. 6, Dec. 1920, pp. 199-202. Economical aspects of problem. Suggested classification of streets for fixing widths. Paper read before American Society for Municipal Improvements.

Zoning. Relation of Zoning to City Planning, Thomas Adams. Can. Engr., vol. 40, no. 2, Jan. 13, 1921, pp. 127-128. Earlier plans placed great emphasis on transportation and park systems, practically ignoring industrial and residential development. Present tendency is to lean toward other extreme. All must be considered in proper relative proportion.

COAL

Pulverized. *See Pulverized Coal.*

Utah, Coking Properties. Low-Temperature Coking of Utah Coals, Osborn Monnett. Chem. & Metallurgical Eng., vol. 23, no. 26, Dec. 29, 1920, pp. 1246-1249, 2 figs. Summarized description of laboratory investigations made to determine coking property of series of Utah coals. Analysis of coals tested. Apparatus used. Tabulated results obtained.

COAL HANDLING

Hydraulic Conveyors. Conveying Bulk Material Through Pipes, George Frederick Zimmer. Eng. & Indus. Management, vol. 4, no. 25, Dec. 16, 1920, pp. 791-792, 3 figs. Scheme for handling coal hydraulically.

Power Plants. Fuel Handling. Power Plant Eng., vol. 25, no. 1, Jan. 1, 1921, pp. 2-14, 19 figs. Comparison of various methods of handling fuel economically in power plant.

COAL STORAGE

Methods. Coal Storage. Power Plant Engr., vol. 25, no. 1, Jan. 1, 1921, pp. 14-23, 13 figs. Methods of storing coal in piles in the open, and arrangement of conveyors to carry coal to plant.

COKE

Blast-Furnace. Determination of the Hardness of Blast-Furnace Coke, Owen R. Rice. Min. & Metallurgy, no. 167, Nov. 1920, pp. 34-35. Soft coke is deprecated for proper blast furnace operation. Methods of measuring coke hardness. (Abstract.)

House Heating with. By-Product Coke, Anthracite, and Pittsburgh Coal as Fuel for Heating Houses, Henry Kreisinger. Jl. Indus. & Eng. Chem., vol. 13, no. 1, Jan. 1921, pp. 31-33, 1 fig. Based on tests made at fuel laboratory of Bureau of Mines, Pittsburgh.

Metal Melting with. Coke and By-Products as Fuels for Metals Meltings, F. W. Sperr, Jr. Min. & Metallurgy, no. 167, Nov. 1920, p. 33. Growth of use of coke-oven tar as metallurgical fuel during past few years. With properly selected coals, modern by-product coke plant will produce straight gas having heating value of 560 B.t.u. per cu. ft. after removal of benzols. (Abstract.)

COKE MANUFACTURE

By-Product. By-Product Coking, F. W. Sperr, Jr., and E. H. Bird. Jl. Indus. & Eng. Chem., vol. 13, no. 1, Jan. 1921, pp. 26-31. Comparison of by-product and beehive ovens.

COKE OVENS

By-Product. By-Product Coke Ovens Plants of Yesterday and Today, J. M. Hastings, Jr. Coal Industry, vol. 4, no. 1, Jan. 1921, pp. 44-47, 6 figs. Progress of art in 28 years as illustrated by old and new plants of Semet-Solvay Co.

The By-Product Coke Oven Industry, 1920, D. J. Ramsburg. Coal Industry, vol. 4, no. 1, Jan. 1921, p. 52. First large battery of triangular flue type ovens completed and successfully operated during year.

COLUMNS

Design. Maximum Stresses in Short Circular Columns of Masonry, Eccentrically Loaded, R. E. Stradling. Concrete & Constructional Eng., vol. 15, no. 12, Dec. 1920, pp. 793-803, 9 figs. Formulae and graphs.

COMBUSTION

Co_2 Recorders. The Unograph—An Automatic Continuous Analyzer without Chemical Absorption (L'"Unographe," analyseur continu et automatique sans absorption chimique), J. Izart. Chaleur et Industrie, no. 7, Oct. 1920, pp. 433-435, 3 figs. Principle and operation of Dommer CO2 recorder.

CONCRETE

Sea Water, Effect of. More Observations of Effect of Sea Water on Concrete. Eng. News-Rec., vol 86, no. 3, Jan. 20, 1921, pp 121-123, 2 figs. Report on condition of test piles placed by Aberthaw Construction Co in Boston harbor 11 years ago, together with account of observations on concrete piers extending into Pacific in Southern California.

CONCRETE, REINFORCED

Bond Resistance. Tests of Bond Resistance Between Concrete and Steel, W. A. Slater, F. E. Richart and G. G. Scofield. Technologic Papers, Bur of Standards, no 173, Nov. 1, 1920, 66 pp., 79 figs. Results of three dissimilar investigations which were made by concrete ship section of Emergency Fleet Corporation. One investigation was made to study effect on bond resistance of applications of various anticorrosive coatings on reinforcement; second investigation was made to study length of lap required for effective splicing of reinforcing bars in regions of high tensile stress; their investigation was made to study relative merits of different methods of anchoring ends of stirrups to meet certain conditions which arise in concrete ship construction.

CONDENSERS, STEAM

Naval Uses. Service Experience with Condensers, G. B. Allen. Power, vol. 52, no. 23, Dec. 7, 1920, pp. 914-916, 2 figs. Experience of British Admiralty. (Abstract.) Paper read before Inst. of Metals.

CONTRACTS

Cost-Plus. Cost-Plus Contracts, J. C. Keith. Jl. Eng. Inst. Canada, vol. 4, no. 1, Jan. 1921, pp. 8-11. Explanation of difference between cost-plus and unit-price form of contract, advantages and disadvantages, with examples, of contracts on cost-plus basis.

Factories. Conveyance in Workshop (Werkstättentransporte). Betrieb, vol. 3, no. 5, Dec. 10, 1920, pp. 37-38. Preliminary program prepared by the Committee for Economic Production dealing with following subjects: Determination of fundamental principles for economical use; establishment of useful sphere of hand and motor conveyors; adaptation of conveyor to its particular useful sphere, etc.

CONVEYORS

Belt. General Types of Blct Conveyors, S. C. DeWitt. Can. Manufacturer, vol. 41, no. 1, Jan. 1921, pp. 62-64, 5 figs. Suitability of various types for different materials.

Foundry. Foundry Conveyor Equipment Offers Ideas for Adaptation Elsewhere, Norman G. Shidle. Automotive Industries, vol. 43, no. 26, Dec. 23, 1920, pp. 1274-1277, 9 figs. Methods of handling castings and other materials by means of various types of conveyors in foundry of Hercules Gas Engine Co.

Gravity. The Gravity Conveying System, L. T. Sylvester. Can. Manufacturer, vol. 41, no. 1, Jan. 1921, pp. 70-71, 9 figs. Typical installation.

COPPER METALLURGY

Smelter Stacks. *See Chimneys.*

CORES

British Foundry Practice. Core Making Practice In Britain. Foundry, vol. 49, no. 2, Jan. 15, 1921, pp. 69-71, 9 figs. Cores employed to form exterior as well as interior of castings are recognized as economical factor in reducing cost of molding.

COST ACCOUNTING

Charts. How Graphics Help in Estimating Cost, J. B. Carr. Indus. Management, vol. 61, no. 1, Jan. 1, 1921, pp. 41-44, 4 figs. Method is illustrated by applying it to determine cost of Scotch boilers of various styles and sizes.

Making Statistics Talk—II, M. C. Rorty. Indus. Management, vol. 61, no. 1, Jan. 1, 1921, pp. 45-50, 13 figs. Exemplifies values and importance of charts in cost accounting.

Comparative Records. Comparative Cost Records as an Aid to Manufacturing Profits, Stephen R. Gordon. Indus. Management, vol. 61, no. 1, Jan. 1, 1921, pp. 17-22, 13 figs. How attention to details, such as decreasing waste in cutting cloth in textile mill and irregular stretching in dye house effected savings of more than $16,000 a year.

Overhead Expense. Machine-Hour Rate Method of Distributing Manufacturing Expense, C. Haigh. Machy. (N. Y.), vol. 27, no. 4, Dec. 1920, pp. 370-372. Comparison of man-rate and machine-hour rate method of considering overhead expense. Paper read before Am. Gear Manufacturers' Assn.

COTTON

Finishing Plants. Power Applications to Cotton-Finishing Plants, Leo Loeb. Mech. Eng., vol. 43, no. 1, Jan. 1921, pp. 5-8, 7 figs. Generation of power and of steam and applications to driving of process machinery are traced from boilers to motor applications. Charts are presented showing steam consumption and proportion of exhaust steam converted into work and available at exhaust for different types of prime movers. Illustrations of typical drives are included.

CRANES

I-Beam Girders. Properties of Crane Girder Sections, John H. Sawkins. Eng. News-Rec., vol. 86, no. 1, Jan. 6, 1921, p. 13, 2 figs. Table of mechanical properties of I-beam crane griders with lateral stiffening channels.

CRANES

Long-Span. A New Form of Long Span Crane. Engr., vol 130, no 3391, Dec. 24, 1920, pp 631-632, 5 figs. General feature is that although crane has overhead girder spanning site of its operations, load is not carried directly by this girder, but by cableway attached to its two ends.

CUTTING TOOLS

Construction. Metal Cutting Tools, A. L. De-Leeuw. Am. Mach., vol. 54, no. 1, Jan. 6, 1921, pp. 1-7, 21 figs. Analogy between actions of razor hatchet and metal cutting tools. Formation of chips. Elementary considerations in construction of simple tools.

Grinding. Grinding Lathe and Planer Tools. Mach. (Lond.), vol 17, no. 432, Jan. 6, 1921, pp. 418-420, 2 figs., correct angle to use when grinding. Power consumption for different angles and position of lathe tools.

Inserted Cutters. The "Herbert" Patent High Duty Inserted Tooth Face Cutter. Practical Engr., vol 62, no. 1766, Dec. 30, 1920, pp. 420-422, 5 figs. Invention is applicable to milling cutters, boring bars and generally wherever body of tool may be made of softer steel than that of tooth.

Screw Threads. Spring Tool for Cutting Threads. Iron Age, vol. 107, no. 3, Jan. 20, 1921, p. 208, 1 fig. Tool utilizes goose-neck principle to eliminate chatter and permit cutting of smooth threads on lathe work.

CYLINDERS

Castings. Make Marine Cylinders in New Shop, Herbert R. Simonds. Foundry, vol. 49, no. 1, Jan. 1, 1921, pp. 1-4, 7 figs. Making of castings at Boston Navy Yard.

D

DAMS

Automatic. Types of Automatic Dams (Description de quelques types de barrages automatiques), H. F. Weber. Revue générale de l'Electricité, vol. 8, no. 26, Dec. 25, 1920, pp. 897-906, 10 figs. Salient features of automatic dam on Chippewa, Wis. and of automatic dam at St-Vertraud-sur-Lavant, France.

Design. Volume Relation of Constant Angle Arch Dams and Gravity Dams, B. J. Jakobsen. Eng. & Contracting, vol. 54, no. 23, Dec. 8, 1920, pp. 554-555, 8 figs. Theory of constant angle arch dam and of gravity dam. Formulæ are developed which give approximately yardage required for constant angle arch dam and for gravity dam, and comparisons are given of two types for various sites.

DIES

Compound. Compound Blanking, Forming and Piercing Die, F. H. Lejeune. Machy. (N. Y.), vol. 27, no. 5, Jan. 1921 pp. 441-442, 3 figs. Die for producing tractor-wheel spoke covering one operation.

Locomotive Parts. Special Railroad Machine-Forging Tools, J. V. Hunter. Am. Mach., vol. 54, no. 2, Jan. 13, 1921 pp. 67-68, 7 figs. Description of dies used for forging locomotive grease cups, universal-joint jaws, connecting rods, valve handles, boiler-flue beading tools, etc.

Seamless Kettles. Drawing Operations on Seamless Kettles, Fred R. Daniels. Machy. (N. Y.), vol. 27, no. 5, Jan. 1921, pp. 433-437, 18 figs. Design of dies and step-by-step operations in making difficult drawn shape.

DIESEL ENGINES

Solid-Injection. The Solid Injection Engine, C. McTaminey. Trans. Inst. Mar. Engrs., vol. 32, Nov. 1920, pp. 161-178 and (discussion) pp. 179-194, 4 figs. Details of construction of Diesel marine installations developed by British Admiralty during war.

DRILLING MACHINES

Automatic. Automatic Drilling Machine with Gravity Feed. (Machy. Lond.), vol. 17, no. 431, Dec. 30, 1920, pp. 396-397, 2 figs. Each of two spindles operates independently, and feeding of drill into work is accomplished by weight which exerts constant feeding pressure during drilling operation.

Radial. Large Radial Drilling Machines, Eng. Production, vol. 2, no. 14, Jan. 6, 1921, pp. 22-23, 1 fig. Designed for use on large turbine work.

DRILLS

Twist. Helix Angle of Twist Drills, Bruce W. Benedict. Am. Mach., vol. 53, no. 26, Dec. 23, 1920, pp. 1175-1178, 5 figs. Concludes from experiments that with present design of flute, most efficient high-speed milled twist drill has helix angle of 35 deg., and that drill with this angle has greater endurance than drills of other helix angles.

DUST

Action, Theory of. Theory of Dust Action, O. W. Armspach. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 26, no. 9, Dec. 1920, pp. 819-829, 6 figs. Report upon investigations carried out jointly by Research Bureau & U. S. Bureau of Mines. It is shown that dust content in room depends upon density of material, velocity of fall of particles and size of room; dust will accumulate until definite content is reached depending upon rate of fall and number of air changes.

E

ECONOMIZERS

Installation. Economizers, W. F. Wurster. Jl. Am. Soc. Heat & Vent. Engrs., vol. 26, no. 9, Dec. 1920, pp. 811-818, 6 figs. Typical installations of economizers steam power plants.

Operation. Two Useful Suggestions in Regard to Operation of Economizers (Deux points utiles à connaître concernant les économiseurs), Henry Dieterlen. Chaleur & Industrie, no. 8, Nov.-Dec. 1920, pp. 487-489, 3 figs. How to prevent trouble in pumps arising from hot water used, and how to prevent vapor condensation on outside of economizer.

EDUCATION, INDUSTRIAL

Co-operative High-School Course. The Industrial Co-operative Course of the Lansing High School, E. M. Hall. Am. Mach., vol. 54, no. 3, Jan. 20, 1921, pp.83-86, 13 figs. Course, open to youths of city of Lansing, intended to provide thorough training and experience in technical trades.
See also Vocational Education.

ELECTRIC DISTRIBUTION

Economics. Economics of Electrical Distribution, P. O. Reyneau and H. P. Seelye. Elec. World, vol. 77, no. 2, Jan. 8, 1921, pp. 79-81, 2 figs. Application of fundamental underlying principles to problem of transmitting electrical energy from central station to consumer. Indicates how most economical installations consistent with good service can be determined.

ELECTRIC DRIVE

Refrigerating Plants. Electric Drive for Ice Making and Refrigerating Plants, William J. Bray. Ice & Refrigeration, vol. 60, no. 1, Jan. 1921, pp. 23-25, 3 figs. Types of apparatus.
See also Rolling Mills, Electrically Driven.

ELECTRIC FURNACES

Annealing. Electric Annealing and Heat Treating Furnaces, George P. Mills. Jl. Engrs. Club of Phila., vol. 38-1, no. 193, Jan. 1921, pp. 25-31, 6 figs. Ni-chrome resistor type of electric furnace. Operating data on typical installations and probable trend of new applications.

Booth Rotating. Booth Rotating Electric Brass Furnace. Metal Industry (Lond.), vol. 17, no. 26, Dec. 24, 1920, pp. 507-508. Features of later designs. Automatic electrode control.

Iron-Smelting. Swedish Electric Pig Iron Furnaces, Jonas Herlenius. Chem. & Metallurgical Eng., vol. 24, no. 3, Jan. 19, 1921, pp. 108-112, 3 figs. Description of Swedish electric furnace and summary of results obtained from its use.

Refractories for. Refractories for Electric Furnace, R. M. Howe. Chem. & Metallurgical Eng., vol. 23, no. 25, Dec. 22, 1920, pp. 1215-1218. Description of properties of refractory brick and of raw materials employed in their manufacture, with review of many factors involved in efficient use of refractories in general. Paper read before Elec. Furnace Assn.

Synthetic Pig Iron. *See Pig Iron, Synthetic.*

Uses. Electric Furnace Usage Fast Increasing, Elec. World, vol. 77, no. 2, Jan. 8, 1921, pp. 77-79, 3 figs. More than 220 non-ferrous furnaces installed during 1920. Total connected furnace load estimated at 880,000 kva., of which 410,000 kva. is in commercial furnaces. Electric steel output reduced.

ELECTRIC GENERATORS, D.C.

Voltage Relations. Voltage Relations in Direct-Current Machines, R. E. Ferris. Elec. Jl., vol. 18, no. 1, Jan. 1921, pp. 32-36, 19 figs. Formulae for computing voltage between coils in same slots, voltage between turns, etc.

ELECTRIC LOCOMOTIVES

C. M. & St. P. New Electric Passenger Locomotives in Operation on the C. M. & St. P. Railway, W. H. Munn. Jl. Western Soc. Engrs., vol. 26, no. 1, Jan. 1921, pp. 26-29, 2 figs. Characteristics: Total weight, 275 tons; number of driving axles, 6; classification, 4-6-2-2-6-4; tractive effort, continuous rating, 49,000 lb.; speed maximum, 65 m.p.h.

Switzerland. The Locomotives of the Swiss Railways (Les locomotives des chemins de fer rhetiques), Lucien Pahin. Revue Générale de l'Electricité, vol. 8, no. 25, Dec. 18, 1920, pp. 872-878, 8 figs. Details of electric locomotives of Brown Boveri & Co.

ELECTRIC MOTORS

Adjustable Speed. Efficiency of Adjustable Speed Motors, R. W. Owens. Elec. Jl., vol. 18, no. 1, Jan. 1921, pp. 11-14, 5 figs. Typical curves for motors when speed is changed by varying shunt field and speed-torque curve of induction motor.

ELECTRIC MOTORS, A.C.

Induction. Application of Induction Motors—II, Frazer Jeffrey. Power, vol. 52, no. 19, Nov. 9, 1920, pp. 736-739, 6 figs. Comparative curves of high-speed and low-speed induction motors.

ELECTRIC MOTORS, D.C.

Speed Control. Speed Control of Direct-Current Motors in Ventilation Service, William H. Easton. Power, vol. 52, no. 25, Dec. 21, 1920, pp. 970-971, 1 fig. Types of speed control and method for determining most economical type for given installation.

ELECTRIC PLANTS

Interconnection. Co-operation for the Central Station and Isolated Plant, Elec. World, vol. 77, no. 1, Jan. 1, 1921, p. 11. Interconnection is economically sound and is shown to hold mutual advantages where isolated plants can be justified.

ELECTRIC RAILWAYS

Buses vs. The Bus and the Trolley, H. B. Titcomb. Elec. Ry. Jl., vol. 57, no. 2, Jan. 8, 1921, pp. 81-83. Records of motor truck traffic in California held as evidence that motor trucks cannot compete with steam and electric railways in transportation of freight.

Current Losses in Track. Current Losses in Track of Electric Railways (Sur les pertes de courant qui se produisent le long des voies de tramways), G. Girousse. Revue générale de l'Electricité, vol. 8, no. 24, Dec. 11, 1920, pp. 840-846, 19 figs. Formulae for computing intensity and direction of electrolysis currents.

Operation. Log of a Continuous 440-Mile Locomotive Run, Alexander McIver. Ry. Elec. Engr., vol. 12, no. 1, Jan. 1921, pp. 31-37, 6 figs. Records of operation of electrified section of C. M. & St. P.

Train Handling with Electric Locomotives, W. S. H. Hamilton. Ry. Elec. Engr., vol. 12, no. 1, Jan. 1921, pp. 11-16, 5 figs. Notes on passenger car service and passenger train handling.

Snow Fighting. Snow Fighting Methods, E. Seara. Elec. Jl., vol. 18, no. 1, Jan. 1921, pp. 39-40, 3 figs. Practice and equipment used on electrified section of Chicago, Milwaukee & St. Paul Railroad.

ELECTRIC RAILWAYS, TRACK

Rebuilding. New Method of Renewing and Concreting Track Under Traffic. Elec. Traction, vol. 16, no. 12, Dec. 1920, pp. 963-964. 2 figs. How Dayton, Springfield & Xenia Southern is rebuilding single track under traffic with ties set in concrete.

ELECTRIC SWITCHES

Design. Mathematical Analysis of the Mechanical Forces Acting on Switches and Busbars, L. B. W. Jolley. Elecn., vol. 85, no. 2221, Dec. 10, 1920, pp. 676-677, 2 figs. Calculations and tests compared. (Concluded.)

ELECTRIC TRANSMISSION LINES

Design. Design and Maintenance of Distribution Systems, R. H. Rice. Elec. Rev., (Chicago), vol. 78, no. 2, Jan. 8, 1921, pp. 57-62. 4 figs. Standard construction, distribution centers, periodic inspection, line, transformer and service maintenance and records. Paper before Southeastern Geographic Division, N.E.L.A.

ELECTRIC WELDING, ARC

Boiler Repairing. The Electric Welding of a Corroded Boiler-Shell, A. Kenneth Dawson, Trans. Instn. Min. Engr., vol. 60, part 1, Nov. 1920, pp. 8-12, 3 figs. Reparing of corroded colliery Lancashire boiler by use of portable electric-arc welding apparatus.

Car-Truck Frame. Arc Welding on Railway Properties, A. M. Candy. Elec. Ry., Jl. vol. 57, no. 3, Jan. 15, 1921, pp 121-124, 17 figs. Truck frames manufactured by Government Electric Railways of Sydney, Austalia, and other examples of application of electric welding in manufacture of railway cars.

Equipment. Electric Welding, William T. Bonner, A. A. Nims, C. J. Holslag and H. E. Dralle. Jl. Engrs. Club of Phila., vol. 38-4, no. 193, Jan. 1921, pp. 7-23, 8 figs. Notes on selection of arc welding equipment and fundamentals of its efficient operation.

Practice. Arc Welding Practice, J. H. Anderson. Jl. Elec., vol. 45, no. 12, Dec. 15, 1920, pp. 572-574. Greater flexibility and better control in arc welding are obtained by use of metal instead of carbon electrode. Records of tensile tests of welds are included.

The Welding of Metals by the Electric Arc (La soudure des différents métaux par l'arc électrique), Ch. Andry-Bourgeois. Electricien, vol. 51, no. 1266, Dec. 15, 1920, pp. 536-539, 1 fig. Welding of bronzes and aluminum alloys. (Continuation of serial).

Steel. Electric-Arc Welding of Steel: 1. Properties of the Arc-Fused Metal, Henry S. Rawdon, Edward C. Groesbeck and Louis Jordan. Technologic Papers, Bur. of Standards, no. 179, Nov. 15, 1920, 63 pp. 28 figs. Research to determine in empirical way by actual welding tests carried out by skilled operators relative values and merits of different types of electrodes which are available commercially.

ELECTRICAL INDUSTRY

Developments in 1920. Some Developments in the Electrical Industry During 1920, John Liston. Gen. Elec. Rev., vol. 24, no. 1, Jan. 1921, pp. 4-49, 99 figs. Developments in turbo-generators, electric locomotives, electrical machinery, electric cranes, hoists, transformers, insulators and electric lighting.

EMPLOYEES' REPRESENTATION

Shop Committees. A shop Committee that Failed, O. F. Carpenter. Indus. Management. vol. 61; no. 1, Jan. 1, 1921, pp. 59-62. Experience of one firm that introduced industrial democracy.

Works Councils. Works Council after Two Years' Trial. Can. Machy., vol. 24, no. 27, Dec. 30, 1920, pp. 597-600, 6 figs. Experience of International Harvester Co.

EMPLOYMENT MANAGEMENT

Selecting Employees. Fewer Mistakes in Selecting Employees, William S. Dutton. Factory, vol 26, no. 1 Jan. 1, 1921, pp. 38-39, 2 figs. Experiences of E. I. duPont de Nemours & Co.

ENGINEERING SOCIETIES

Progress in 1920. Progress of Engineering Societies in 1920, Calvin W. Rice. Power, vol 53, no. 1, Jan. 4, 1921, pp 22-23 Outstanding event is establishment of Federated American Engineering Societies which typifies "unselfish devotion on the part of the engineering profession to the good of the community and the nation."

ENGINEERS

Registration. Code of Practice and Schedule of Fees for Structural Engineers. Eng. & Contracting, vol. 54, no. 25, Dec. 22, 1920, pp. 603-605. Proposed code of practice for use of members of Structural Engineers-Association of Illinois prepared by committee of association.

Engineering Legislation ofr Ont. Contract Rec., vol. 35, no. 2, Jan. 12, 1921, pp 39-41. Draft bill for registration of engineers, drawn up by Advisory Conference Committee representing civil, mechanical, electrical and mining engineers.

Engineering Legislation in Canada, Fraser S. Keith. Eng. News-Rec., vol. 86, no. 1, Jan. 6, 1921, pp. 21-24. Outline of history of movement for statutory control of professional practice, with synopsis of acts passed by provinces.

Saskatchewan's "Engineering Profession Act." Can. Engr., vol. 39, no. 25, Dec. 16, 1920, pp. 615-618. Text of bill that has been introduced in Saskatchewan Legislature.

Remuneration. Fees and Services of Practicing and Consulting Engineers, W. L. Benham. Eng. News-Rec., vol. 85, no. 27, Dec. 30, 1920, pp. 1266-1267. Report of Committee on fees and services of practicing engineers of American Association of Engineers.

The Engineering Profession and Government Technology, R. S. McBride. Chem. & Metallurgical Eng., vol. 23, no. 26, Dec. 29, 1920, pp. 1265-1267, 3 figs. Need for increasing salaries of government professional employees is brought out by enumeration of series of facts on conditions now existing in different government technical bureaus.

Social Functions. The Engineer's Service to Society, Fred. J. Miller. Mech. Eng., vol. 43, no. 1, Jan. 1921, pp. 1-4 and 8. Discusses influence of engineer in constructive adjustment, property rights and human rights and relations between employer and employee. Presidential address at Annual Meeting of Am. Soc. Mech. Engrs.

ENGINEHOUSES

Design. Modernizing Locomotive Terminals, G. W. Rink. Mech. Eng., vol. 43, no. 1, Jan. 1921, pp. 13-16, 5 figs. Location size and general layout of terminal are dependent on various elements, two principal factors being character of work to be performed and location of general locomotive repair shop. Necessity for providing modern facilities is discussed with a view of awakening an interest in this subject, which has important bearing on ability of railroads to handle increased traffic demands of country.

EXECUTIVES

Industrial. The Executive—and Today's Problem, Lewis E. Pierson. Indus. Management, vol. 61, no. 1, Jan. 1, 1921, pp. 7-8 and p. 50 and 57-58. Suggestions to executives in regard to present business conditions.

EXCAVATORS

Dragline. Electric Dragline Operation on Boise Project, U. S. Reclamation Service. Excavating Engr., vol. 15, no. 1, Jan. 1921, pp. 708, 3 figs. Records of operation.

EXCAVATION, EARTH

Elevating Grader Work. A Study of the Costs of Grading with Elevating Grader and Wagons. Eng. & Contracting, vol. 55, no. 3, Jan. 19, 1921, pp. 53-55. From bulletin of Associated General Contractors of America.

Ejector and Dredge. Groundwater Pumping and Hydraulic Excavation for Beach Hotel Foundation. Eng. News-Rec., vol. 86, no. 2, Jan. 13, 1921, pp. 52-55, 7 figs. Column footings and basement story below water level constructed in open pits kept dry by wellpoint cofferdams. Piling eliminated. Site pumped in sections by local groups of wells. Ejector and dredge excavation.

F

FACTORY MANAGEMENT

See Industrial Management.

FARM MACHINERY

London Show. The Smithfield Club Show. Engr., vol. 130, no. 3389, Dec. 10, 1920, pp. 582-583, 6 figs. Details of farm machinery exhibited at London Show.

FATIGUE

Blast-Furnace Men. Fatigue of Blast-Furnace Men. Iron & Coal Trades Rev., vol. 101, no. 2757, Dec. 31, 1920, pp. 910-911. Report issued by Committee of Industrial Fatigue Research Board England.

FILTERS, SAND

Drifting. Toronto Filtration Plant, James Milne. Jl. Eng. Inst. Canada, vol. 4, no. 1, Jan 1921, pp. 16-21 Details of operations slow sand and drifting sand plants, with tables of operating costs

FIRE PREVENTION

Pulpwood Piles. Fire Prevention in Pulp Wood Piles, F J Hosie. Paper, vol. 27, no. 15, Dec. 15, 1920, pp. 13-19, 13 figs. Spray nozzles forming artificial fog for protection of piles of pulpwood.

FLOW OF AIR

Conduits. Measurement of Quantity of Air Flowing Through a Conduit (La mesure des débits de vent), M. Lebrasseur. Chaleur & Industrie, no. 8, Nov.-Dec. 1920, pp. 474-477, 5 figs. Measurement by Means of Venturi is preferred.

FLOW OF STEAM

See Flow of Water, Transmission Wastes.

FLOW OF WATER

Concrete Pipe Lines. Flow of Water in Concrete Pipe Lines. Can. Engr., vol. 40, nos. 1 and 2, Jan. 6-13, 1921, pp. 101-105, 2 figs., and 124-126, 3 figs. Test data showing effect of variations in character and condition of pipe on coefficients of retardation for various formulæ. Test of big conduit at Niagara Falls.

Dredge Pipes. Velocity Tests in Hydraulic Dredge Pipe, Ivan E. Houk, Eng. News-Rec., vol. 86, no. 1, Jan. 6, 1921, pp. 18-19, 1 fig. Description of apparatus for measuring velocity of dredge pipe discharge, and tables of results obtained.

Transmission Wastes. Transmission Wastes. Power Plant Eng., vol. 25, no. 1, Jan. 1, 1921, pp. 85-93, 11 figs. Chart of flow of water in pipes and loss of head by friction, also for determining loss of steam pressure per 100 ft. of pipe.

FLUE-GAS ANALYSIS

Graphical Method. A Graphical Method for the Interpretation of Flue Gas Analyses, Gilbert B. Howarth. Jl. Soc. Chem. Industry, vol. 39, no. 24, Dec. 31, 1920, pp. 329T-333T, 3 figs. Construction of diagram and its use for commercial purposes.

FLYWHEELS

Stresses in. Resistance of a Disk Subjected to Rapid Rotation (De la résistance des disques à rotation rapide), L. Anspach. Bulletin technique de l'Association des Ingénieurs sortis de l'Ecole Polytechnique de Bruxelles, vol. 14, no. 1, 1920-1921, pp. 21-54, 1 fig. Fundamental formula developed in general case and applied to design and study of flywheels.

FORGING

Brass. Making Brass Forgings. Machy. (Lond.), vol. 17, no. 430, Dec. 23, 1920, pp. 341-346, 10 figs. Methods developed by Mueller Metals Co. in metal working.

Furnaces. The Construction of Ducts for Forge Exhaust and Blast Systems. Heat. and Vent. Mag., vol. 17, no. 12, Dec. 1920, pp. 35-39, 8 figs. Furnace installation at plant of General Vehicle Co., Long Island City.

FOUNDATIONS

Foundations. Their Selection, Design and Construction—V. Am. Architect, vol. 118, no. 2347, Dec. 15, 1920, pp. 795-800, 9 figs. Method of sinking pneumatic caisson.

FOUNDRIES

Aluminum. Analyze Loss in Aluminum Shops—III, Robert J. Anderson. Foundry, vol. 49, no. 2, Jan. 15, 1921, pp. 54-57, 2 figs. Conditions at several typical foundries described, including melting equipment and operation molding methods and inspection routine. Pyrometric control varies in different foundries.

Conveying Equipment. *See Conveyors, Foundry.*

Layout. Foundry Planning by Example, Charles K. Sumner. Metal Trades, vol. 12, no. 1, Jan. 1921, pp. 14-15. Data on twelve existing gray iron foundries in San Francisco and vicinity.

Scrap Recovery. Economy in the Recovery of Scrap in Iron and Steel Foundries (Ueber die Wirtschaftlichkeit der Rückgewinnung des Abeisens in Eisen- und Stahlgiessereien), Hubert Hermanns Betrieb, vol. 3, no. 3, Nov. 10, 1920, pp. 66-67, 1 fig. Includes tabular data compiled from four different plants showing net production costs of recovered scrap, and curves showing results of calculation of operating costs.

See also Cores.

FUELS

Colloidal. Colloidal Fuel as Developed by the Submarine Defence Association of New York. Power Plant Eng., vol. 25, no. 1, Jan. 1, 1921, pp. 55-56, 2 figs. Chart giving comparative savings effected with colloidal fuel.

Colloidal Fuels, Their Preparation and Properties, S. E. Sheppard. Jl. Indus. & Eng. Chem. vol. 13, no. 1, Jan. 1921, pp. 37-47, 12 figs. Survey of developments.

Conservation. Fuel and its Conservation, L. P. Breckenridge, O. P. Hood, David Moffat Myers and Chester G. Gilbert and Joseph E. Pogue. Mech. Eng., vol. 43, no. 1, Jan. 1921, pp. 22-28 and (discussion) pp. 28-31 and 38. Group of papers dealing with fuel supply of world, fuel conservation, distillation of fuels, and form value of energy, with discussion thereon, which were presented at 1920 Annual Meeting of Am. Soc. Mech. Engrs.

Economical use. Rational Utilization of Fuels (L'utilisation rationnelle des combustibles), Georges Charpy, Emilio Damour, E. De Loisy, M. Ader, Ch. Berthelot. Mémoires et Compte rendu des Travaux de la Société des Ingénieurs civils de France, vol. 73, nos. 4, 5 and 6, April-June, 1920, pp. 245-393. Symposium on fuel economy. Principles of economic composition of various fuels, gaseous, liquid and solid. Suggestions in regard to their economic utilization in industrial works.

Oil. *See Oil Fuel.*

FURNACES, BOILER

Lignite-Burning. The Adaptation of Steam-Boiler Furnaces to the Burning of Lignite (Umstellung von Dampfkesselfeuerungen auf Braunkohle), H. Berner. Zeit. für Dampfkessel u. Maschinenbetrieb, vol. 43, no. 42-43, Oct. 22, 1920, pp. 321-322. Points out advantages and disadvantages of the forced-draft horizontal grate.

Low-Grade Fuels. The Adaptation of Steam-Boiler Furnaces to Low-Grade Fuels (Die Umstellung der Dampfkesselfeuerungen auf minderwertige Brennstoffe). Zeit. des Vereines deutscher Ingenieure, vol. 64, no. 51, Dec. 18, 1920, pp. 1069-1070. Full report published by the Board of Heat Conservation giving experiences recorded at the convention of Board in Berlin, September, 1920.

FURNACES, OPEN HEARTH

Waste Heat Boilers. Application of Waste Heat Boilers to Open Hearth Furnaces, Thomas R. Tate. Assn. Iron & Steel Elec. Engrs., vol. 2, no. 12, Dec. 1920, pp. 1-6 and (discussion) pp. 6-10. Method of determining proper size and type boiler for any installation.

G

GAGES

Checking. Keeping an Accurate Check on Gages, J. Edward Schipper. Automotive Industries, vol. 43, no. 25, Dec. 16, 1920, pp. 1225-1227, 7 figs. Method of checking gages at plant of Lincoln Motor Co.

GAS ENGINES

Blast Furnace Gas. Cockerill Blast-Furnace Gas Engines, H. Hubert. Engr., vol. 130, no. 3386, Nov. 19, 1920, pp. 495-498, 11 figs. Performance tests.

Design. Recent Improvements in Large Gas Engines (Les derniers perfectionnements aux moteurs à gas de grande puissance), H. Feron. Vie technique & industrielle, vol. 2, no. 13, Oct. 1920, pp. 14-17, 7 figs. Design of special fixtures and attachments for gas engines of more than 1000 hp.

Vertical. 120 H. P. Vertical Gas Engine. Engr., vol. 130, no. 3388, Dec. 3, 1920, p. 567, 2 figs. Three-crank vertical engine with one cylinder, 13-m. bore and 14-in. stroke for each crank and capable of giving constant output of 102 b.hp. on producer gas.

GASOLINE

Hecter Fuel. Comparison of Hecter Fuel with Export Aviation Gasoline, H. C. Dickinson, V. R. Gage and S. W. Sparrow. Nat. Advisory Committee for Aeronautics, report no. 90, 1920, 10 pp., 13 figs. Investigation conducted at altitude laboratory of Bureau of Standards. Hecter fuel is mixture of approximately 30 per cent benzol, 70 per cent cyclohezane by volume. For flight at low altitudes Hecter fuel showed slight advantages in comparison with gasoline by affording small increase of power over and above that necessary to offset disadvantage of increased fuel consumption. At 14,000 feet and 25,000 feet no appreciable difference in power was obtained, whereas fuel consumption of Hecter was greater to extent of 15 per cent by weight.

Natural Gas. Treating Natural-Gas Gasoline to Meet the "Doctor Test," D. B. Dow, Reports of Investigations, Bur. of Mines, Dept. of Interior, serial no. 2191, Dec. 1920, 4 pp. Basis for installation of economical treating process.

GASOLINE ENGINES

Exhaust Gases. Exhaust Gases of Petrol Engines, Times Eng. Supp., no. 554, Dec. 1920, p. 382. Methods of utilization.

GEARS

Bevel. Chordal Thickness of Tooth and Corrected Pitch Depth of Bevel Gears. Machy. (Lond.), vol. 17, no. 432, Jan. 6, 1921, pp. 423-424, 1 fig. Diagram showing dimensions and angles used in determining chordal thickness and corrected pitch depth of bevel gear teeth.

Horsepower Chart. Horsepower Chart for Gear Teeth. Machy. (Lond.), vol. 17, no. 430, Dec. 23, 1920, pp. 359-360, 1 fig. Chart for determining horsepower transmitted by gears when load is known.

Layout. Laying Out Gearing and Making Gear Patterns, H. J. M'Caslin. Can. Foundryman, vol. 12, no. 1, Jan. 1921, pp. 28-29, 3 figs. Study of gearing including spur, bevel and miter gears, involute and epicycloidal teeth, circular and diametral pitch and other features in connection with gearing.

Worm. The Efficiency of Worm-Gearing, W. S. Atkinson. Machy. (N. Y.), vol. 27, no. 4, Dec. 1920, pp. 315-316, 2 figs. Formulæ for computing efficiency in various cases.

GRINDING

Cylindrical. Work Speeds in Cylindrical Grinding, Robert J. Spence. Machy. (N. Y.), vol. 27, no. 5, Jan. 1921, pp. 438-440. Importance of instructing operators concerning proper work speeds to be used. Results obtained by reducing work speed.

GRINDING MACHINES

Surface. Wilmarth & Morman Company's No. 78 Surface Grinding Machine. Am. Mach., vol. 54, no. 2, Jan. 13, 1921, pp. 41-42, 1 fig. Two precision screws used for adjusting wheel to cut. Clutch and all gears run in oil.

GUN METAL

Non-Corrodible. The Development of Non-Corrodible Gun Barrels. F. A. Fahrenwald. Monthly Bul. Can. Inst. Min. & Metallurgy, no. 105, Jan. 1921, pp. 27-48, 2 figs. Objections to present-day gun steels are pointed out and materials for purpose are suggested.

H

HARDENING

Fire Cracls. Fire Cracks and Some of Their Causes, J. V. Emmons. Metal Trades, vol. 12, no. 1, Jan. 1921, pp. 22-25, 9 figs. From "Metal Heating" published by Tate, Jones & Co., Inc., furnace engineers, Pittsburgh.

HEAT TREATING

Industrial Applications. Industrial Applications of Heat Treating (Les traitements thermiques dans leur application actuelle), Arnould De Grey. Chaleur et Industrie, no. 7, Oct. 1920, pp. 419-428, 1 fig. Recent progress in tempering and hardening processes.

Thermal Analysis. Industrial Apparatus for Thermal Analysis in Heat Treating (Appareil industriel d'analyse thermique), M. Pierre Chevenard. Revue de Métallurgie, vol. 17, no. 10, Oct. 1920, pp. 687-695, 8 figs. Apparatus registers, in terms of time, temperature of sample submitted to regular heat-treating process and then left to itself to cool.

HEATING AND VENTILATION

Museums. The Heating and Ventilation of Museums (Die Beheizung, Luftzu- und abführung und Luftbefeuchtung der Museen), H. Hasak. Gesundheits-Ingenieur, vol. 43, no. 43, Oct. 13, 1920, pp. 508-510. Writer describes system planned by him and adopted by the Kaiser-Wilhelm Museum in Berlin, Germany, where it has given great satisfaction, with regard to uniform heating, removal of dust from air, supplying moisture to air, etc.

Paper-Machine Rooms. Heating and Ventilation of Paper Machine Rooms, Edward A. Ryan. Jl. Eng. Inst. Canada, vol. 4, no. 1, Jan. 1921, pp. 21-27 and (discussion) pp. 28-31, 7 figs. Analysis of heating and ventilation problem for paper machine room, need for adequate ventilation to remove moisture and description of systems in use and proposed.

HELICOPTERS

Problem of. The Problem of the Helicopter. Aeronautical Jl., vol. 25, no. 121, Jan. 1921, pp. 3-19, 10 figs. Probable characteristics of first type of helicopter which will be constructed.

LIME

Hydrated Lime. A Chemical Engineering Product, Lucius E. Allen. Jl. Eng. Inst. Canada, vol. 4, no. 1, Jan. 1921, pp. 11-15. Properties, manufacture and use.

HYDRAULIC TURBINES

Manufacture. Machining Large Water Turbines, Fred H. Colvin. Am. Mach., vol. 53, no. 27, Dec. 30, 1920, pp. 1234-1236, 5 figs. Examples of turbine work at shop of Pelton Water Wheel Co., San Francisco.

HYDRODYNAMICS

Vortices in Liquids. Motion of Liquids (Sur le mouvement permanent des liquides), L. Lecornu. Comptes rendus des Séances de l'Académie des Sciences, vol. 171, no. 19, Nov. 8, 1920, pp. 881-885. Equations of vortex motion.

HYDROELECTRIC PLANTS

California. Forward Steps in California Hydro-Electric Designs. Eng. News-Rec., vol. 85, no. 27, Dec. 30, 1920, pp. 1260-1262, 3 figs. Unusual features include 200,000-volt transmission lines and larger units and higher reaction-turbine heads than have previously been used.

Chile. Braden Copper Company's Power System in Chile. Power, vol. 52, no. 19, Nov. 9, 1920, pp. 730-734, 8 figs. Two hydroelectric plants supply power to copper mines. One 22,500-kw. plant operated under 1550-ft. head. Other plant, 15,000 kw., operates under 440-ft head.

France. Hydroelectric Project for Complete Utilization of water Power in Allier Valley (Aménagement hydraulique intégral de la vallée de l'Allier). Revue générale de l'Electricité, vol. 8, no. 26, Dec. 25, 1920, pp. 907-915, 10 figs. Study for utilization of water power. From report submitted by various official committees.

The Hydroelectric Plants at Louron (Usines hydroélectriques du Louron), Marcel Waterneaux, Revue générale de l'Electricite, vol. 8, no. 22, Nov. 27, 1920, pp. 765-778, 20 figs. Description of plants and details of transmission lines. Energy is transmitted at 125,000 volts.

5000-Ft. Head. A 5000-Ft Head Hydro-Electric Plant, Eng., vol. 110, no 2869, Dec. 24, 1920, pp 823-826, 7 figs Installation at Fully, Switzerland. Generating station contains four sets each of 3000 hp., which run at 500 r p m., the Pelton wheels each having single jet which strikes wheel horizontally at its lowest point.

Lock Operation. The Influence of Lock Operation on the Hydroelectric Plants on the Canalized Neckar River (Der Einfluss der Schiffschleusungen auf die Wasserkraftanlagen an dem zu kanalisierenden Neckar) Zentralblatt der Bauverwaltung, vol. 40, no. 77, Sept. 25, 1920, pp. 485-490, 7 figs. Gives results of locking experiments in the supply channel of the municipal electric power station in Poppenweiler, from which it is concluded that an interruption of operation of power station through navigation of canal need not take place providing proper measures are carried out with regard to requirements of navigation.

Low-Head. Developing the Low-Head Plant, Louis E. Ayres. Elec. World, vol. 76, no. 26, Dec. 25, 1920, pp. 1260-1263, 4 figs. Rehabilitation of old plants by installing hydraucones with high-speed runner. Gain in efficiency should be at least 25 per cent. Comparison of hydraucone with stream line draft tube.

Niagara Falls Power Development. Switch and Control Equipment at Niagara Falls, Stephen Q. Hayes. Elec. Rev. (Chicago), vol 78, no. 2, Jan. 8, 1921, pp. 47-53, 10 figs. Precautions taken to guard generating apparatus. Indicating devices and instruments important factors in station operation. Switchgear for main generating units housed in substation. (To be continued.)

Scotland. The Inshes Hydro-Electric Installation. Elec. Rev. (Lond.), vol. 87, no. 2248, Dec. 24, 1920, pp. 803-804, 6 figs. Detail of 50-kw. hydroelectric scheme in Scotland.

I

ICE PLANTS

Motor-Driven. Motor-Driven Ice-Plants—Electrical Consumption per Ton of Ice, John E. Starr. Power, vol. 52, no. 19, Nov. 9, 1920, pp. 742-743, 1 fig. Under usual conditions of pressures, loads, temperatures and volumetric efficiency, 48.5 kw.-hr. per ton of ice is usual result.

See also Electric Drive, Refrigerating Plants.

INDUSTRIAL EFFICIENCY

Health. The Cult of the Sound Body, T. V. Davidson. Sci. Am. Monthly, vol. 3, no. 1, Jan. 1921, pp. 33-36, 12 figs. Apparatus employed in modern physiological laboratories to test physical development.

INDUSTRIAL MANAGEMENT

Drafting Department. The Industrial Organization of the Drafting Department (L'Organisation industrielle du bureau de dessin), Danty-Lafrance. Vie Technique & Industrielle, vol. 2, no. 14, Nov. 1920, pp. 134-140, 7 figs. Suggestions in regard to adopting symbolic nomenclature, standardization of records, etc.

Employment Relations. Building Workman Morale by Advertising, Harry Botsford. Iron Age, vol. 107, No. 2, Jan. 13, 1921, pp. 131. Dodge Mfg. Co., manufacturers of pulleys and power transmission equipment, display their advertising literature on billboard to inspire workmen to make good tribute paid them in it.

Inspection. Inspection as an Aid to Planning, George S. Radford. Indus. Management, vol. 61, no. 1, Jan. 1, 1921, pp. 25-30. How central inspection regulates flow of work.

Production Systems. Assuring Continuous Production, Elec. World, vol. 77, no. 3, Jan. 15, 1921, pp. 144-146, 3 figs. Standards of inspection adopted in several large plants in connection with successful maintenance work based on long experience under industrial conditions.

Fixtures for Quantity Production of Truck Parts—II. Metal Trades, vol. 12, no. 1, Jan. 1921, pp. 5-10, 10 figs.

Increasing Production with Standard Equipment. Machy. (Lond.), vol. 17, nos. 430 and 431, Dec. 23 and 30, 1920, pp. 347-353 and 380-382, 8 figs. Comparison of output and manufacturing costs for specific drilling operation under varying conditions.

Purchasing Materials. Purchasing Records and System, Wilfred G. Astle. Elec. Traction, vol. 16, no. 12, Dec. 1920, pp. 941-945, 8 figs. Forms for keeping of records.

Routing Work. Handling and Routing Large Work. Mach. (N. Y.), vol. 27, no. 4, Dec. 1920, pp. 358-364, 17 figs. Methods employed by Manning, Maxwell & Moore, Inc., in Putnam Machine Works. Fitchburg, Mass., for routing of work through factory.

Time Study. *See Time Study.*

INDUSTRIAL RELATIONS

Open Shop Movement in U. S. Government Demands Open Shop, T. C. Dickson. Iron Trade Rev., vol. 67, no. 26, Dec. 23, 1920, pp. 1734-1735. Refuses to deal with trade unions in operation of arsenals, though promoting shop committee system of representation. Commanding officer describes War Department's methods in dealing with labor problems. Paper read before National Founders' Assn.

The Open Shop and the Motives Back of It, Ralph E. Fox. Indus. Management, vol. 61, no. 1, Jan. 1, 1921, pp. 37-39. Theory of open shop is opportunity to produce in necessary quantities in order that all may have plenty. Motive that lies back of any industrial plan must eventually determine its right to existence.

Widespread Support of the Open Shop—II, James A. Emery. Iron Age, vol. 106, no. 26, Dec. 23, 1920, pp. 1675 and pp. 1710-1711. Review of events of recent years. Address delivered before National Founders' Assn.

Plans. Relations Between Employers and Employed. Monthly Labor Rev., vol. 11, no. 6, Dec. 1920, pp. 94-103. Portland, Oregon, plan of preventing labor disputes, and Rochester plan of industrial democracy.

INTERCHANGEABLE MANUFACTURE

Allowances. Designations for Allowances (Passungszeichen), C. Volk. Betrieb, vol. 3, no. 3, Nov. 10, 1920, pp. 41-43, 2 figs. Various such designations are shown in a table and chart, giving reasons for designation, advantages and disadvantages. Report of German Industry Committee on Standards.

Fit Allowances. A System of Fit Allowances, Sydney B. Austin. Machy. (Lond.), vol. 17, no. 431, Dec. 30, 1920, pp. 384-386, 3 figs. Curves showing relation of allowances for fits to various diameters. Comparison of theoretical curves with Brown & Sharpe system of fit allowances and with Newall Engineering Co.'s system of fits.

INTERNAL-COMBUSTION ENGINES

Fuels. The Proper Selection of Fuel for the Oil Engine, Allen F. Brewer. Power, vol. 52, no. 25, Dec. 21, 1920, pp. 972-974. Comparative properties of typical oils.

See also Aeroplane Engines; Automobile Engines; Diesel Engines; Gas Engines; Gasoline Engines; Oil Engines; Tractor Engines.

IRON CASTINGS

Fluid Pressure in Moulds. Pressure Due to Fluid Iron in Moulds. C. Webster. Mech. World, vol. 68, no. 1772, Dec. 17, 1920, pp. 442-443, 16 figs. Influence of pressure of fluid iron in straining, bursting and lifting of molds.

IRON METALLURGY

Control of Mixtures. Chemist Controls All Iron Mixtures. Foundry, vol. 49, no. 2, Jan. 15, 1921, pp. 59-62, 5 figs. Melting department in foundry of large plant with diversified output regulated by laboratory. Inclined skip hoist charges cupola.

Elements in Iron Control Mixtures, Fletcher Collins. Foundry, vol. 49, no. 2, Jan. 15, 1921, pp. 64-65. Hardness of cast iron mainly determined by state of carbon which is controlled by other elements. Silicon tends to free carbon and sulphur to hold it in combination.

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KEYWAYS

Depth. Computing the Depth of Keyway in Gear and Pulley Hubs, Henry R. Bowman. Am. Mach., vol. 54, no. 2, Jan. 13. 1921, p. 69. Formula.

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Child. Child Labor. Monthly Labor Rev., vol. 11, no. 6, Dec. 1920, pp. 126-131. Industrial instability of child workers in Connecticut.

LIGHTING

Direct vs. Diffused Light. Pleasing Proportions of Direct and Diffused Light from a Floor Lamp, J. R. Cravath. Trans. Illuminating Eng. Soc., vol. 15, no. 9, Dec. 30, 1920, pp. 631-644, 6 figs. Results of tests to determine pleasing proportions of direct and diffuse light from floor lamp under certain specified conditions.

Industrial. Significant Developments in Illumination During 1920, Preston S. Millar. Elec. World, vol. 77, no. 2, Jan. 8, 1921, pp. 82-85, 6 figs. Types of industrial lighting. Survey of progress in automobile headlight design.

Reflectors. The Standardization of Reflectors for Industrial Lighting. Illuminating Engr., vol. 13, no. 9, Sept. 1920, pp. 253-254, 2 figs. Photometric device for comparing efficiency of reflectors.

LIGNITE

Briquets. Lignite Bricks Pave Canada's Way to Fuel Independence, Walter Noble Burns. Coal Age, vol. 19, no. 2, Jan. 13, 1921, pp. 65-66, 1 fig. Lignite utilization board to place briquets on market. If they prove commercial success 300 new plants will be erected.

Canadian. Carbonization of Canadian Lignite, Edgar Stansfield. Jl. Indus. & Eng. Chem., vol. 13, no. 1, Jan. 1921, pp. 17-23, 4 figs. Laboratory tests by chemical staff of Fuel Testing Division of Mines Branch, Department of Mines, Ottawa.

HOUSES

Concrete-Blocks. Building With Concrete Blocks. Building Age, vol. 43, no. 1, Jan. 1921, pp. 30-35, 7 figs. Tables showing relation between number of courses of concrete block and title and height of wall formed by units of different sizes and number of block required for wall section of various lengths.

Concrete. Concrete Cottage Building. Concrete & Constructional Eng., vol. 15, no. 12, Dec. 1920, pp. 809-817, 10 figs. Typical examples of English design and construction.

Ingersoll System. Further Cost and Construction Notes on Ingersoll System Houses. Concrete, vol. 18, no. 1, Jan. 1921, pp. 27-30, 6 figs. Monolythic structures poured at one operation from top of basement slab to roof parapet.

LOCOMOTIVES

Auxiliary Tractor. Development of the Locomotive Auxiliary Tractor, J. Snowden Bell. Ry. & Locomotive Eng., vol. 34, no. 1, Jan. 1921, pp. 19-21, 5 figs. Survey of patented devices.

Bureau of Locomotive Inspection. Report of the Bureau of Locomotive Inspection, Ry. Mech. Engr., vol. 95, no. 1, Jan. 1921, pp. 18-20, 4 figs. Application of water columns and other devices advocated; accidents increase in fiscal year 1920.

Report of Chief Inspector of Boilers, A. G. Pack. Ry. Jl., vol. 27, no. 1, Jan. 1921, pp. 17-25, 7 figs. Statistics of defects on parts and appurtenances of locomotive and tender, including boiler, together with casualties resulting from failures.

Compressed-Air. Study of the Triple-Expansion Compressed-Air Locomotive and the Utilization of Exhaust Steam in the Compression of Air at High Pressure (Etude sur les locomotives à air comprimé à triple expansion et l'utilisation de la vapeur d'échappement à la production de l'air à haute pression), M. P.-E. Leroux. Bulletin et Comptes rendus mensuels de la Société de l'Industrie minerale, vol. 19, no. 6, Nov.-Dec. 1920, pp. 249-305, 60 figs. Technical and economical study.

Cylinders. Tests of Cast Iron for Locomotive-Cylinder Parts. Am. Mach., vol. 53, no. 27, Dec. 30, 1920, pp. 1221-1222. Mechanical test at Bureau of Standards.

Electric. *See Electric Locomotives.*

Internal-Combustion. Internal Combustion Locomotives and Rail Cars of McEwan and Pratt, Ltd., George Frederick Zimmer. Eng. & Indus. Management, vol. 4, no. 27, Dec. 30, 1920, pp. 849-851, 2 figs. Locomotives used on rail tracks in factories, works, plantations, quarries, mines and also for light transitory purposes for erection of contract work. Special attention is given to reversing machanism.

Lubrication. Lubrication of Locomotives (Lubricacion de locomotoras), J. W. D. Ayre. Ingenieria internacional, vol. 5, no. 1, Jan. 1921, pp. 18-23, 25 figs. Details for economical lubrication.

Manufacture. Production Methods in Railway Locomotive Plants, Machy. (Lond.), vol. 17, no. 432, Jan., 6, 1921, pp. 405-410, 11 figs. Practice of Sir W. G. Armstrong, Whitworth & Co., Ltd., Scotswood, Newcastle-on-Tyne.

Mine. Changes in Electric Locomotives to Meet Demands for Heavier Duty. Graham Bright. Coal Age, vol. 19, no. 2, Jan. 13, 1921, pp. 51-56, 11 figs. Frames of bar steel resist damage and assist ventilation of motors. Leaf spring has advantage over helical. Thrust resisted by removable lid of boxing. Detachable rims and split gears are of questionable merit. Tandem locomotives and fan ventilation meet demand for more power.

Oil-Burning. Oil Burning Tests in the Locomotives of the Paris-Lyons-Mediterranee (Essais de chauffage au mazout effectués par la compagnie P. L. M.), M. Pouillon. Revue générale des chemins de fer, vol. 39, no. 1, July 1920, pp. 3-7. Burner used was of nappe type with pulverization by means of steam. Tests proved satisfactory in all respects.

Reconstruction. Increasing the Capacity of Old Locomotives, C. B. Smith. Mech. Eng., vol. 43, no. 1, Jan. 1921, pp. 12 and 16. Problems of adapting oil-type locomotives to suburban and local service are discussed and items which are to be considered in any program for increasing locomotive capacity are listed. Examples of satisfactory reconstruction are cited.

Speed Capacity. The Speed Capacity of Locomotives, Cecil J. Allen. Ry. Engr., vol. 41, no. 491, Dec. 1920, pp. 489-491. Discussed more particularly in relation to diameter of driving wheels and coupling of axles.

LUBRICATING OILS

Specifications. Lubricating Oils. Air Service Information Circular, vol. 2, no. 118, Oct. 20, 1920, 7 pp., 3 figs. Specifications and method for testing.

Testing. Methods of Examination of Lubricating Oils, G. F. Robertshaw. Jl. Instn. Petroleum Technologists, vol. 6, no. 24, Oct. 1920, pp. 324-364, and (discussion), pp. 364-378, 1 fig. Methods of testing. Bibliography of lubricating oils.

LUBRICATION

Developments. Advances in the Practice of Lubrication, Henry M. Wells and James E. Southcombe. Can. Chem. & Metallurgy, vol. 5, no. 1, Jan. 1921, pp. 10-13. Experimental work connected with introduction of fatty acids in place of fatty oils. Results of trials on all types of machinery.

Oil-Circulation Systems. Preventing Emulsification in Oil-Circulating Systems, R. E. Langston. Power, vol. 52, no. 19, Nov. 9, 1920, pp. 470-471, 2 figs. Kind of oil to use in circulation systems to avoid forming emulsion.

Problems of. Some Problems of Lubrication, W. B. Hardy. Nature (Lond.), vol. 106, no. 2670, Dec. 30, 1920, pp. 569-572. Experiments to study relation of lubricating power to chemical constitution.

Research. British Lubrication-Research Report. Commerce Reports, no. 9, Jan. 12, 1921, pp. 211-213. Final report of British Department of Scientific and Industrial Research. (Abstract.)

Lubricants and Lubrication. Engr., vol. 130, no. 3390, Dec. 17. 1920, p. 605. Report of Lubricant and Lubrication Inquiry Committee appointed by Advisory Council of Department of Scientific and Industrial Research.

Lubrication. Times Eng. Supp., no. 554, Dec. 1920, p. 381. Report of Lubricants and Lubrication Inquiry Committee set up by Department of Scientific and Industrial Research.

M

MACHINE SHOPS

Layout. Accessibility, Convenience and Cleanliness Make This Machine Shop Efficient, Dever C. Ashmead. Coal Age, vol. 18, no. 26, Dec. 23, 1920, pp. 1269-1271, 4 figs. Layout of machine shop near Hazleton, Pa.

MACHINE TOOLS

Automatic. The Galco Automatic Machines (Les machines automatiques "Galco"), M. Rousquet. Vie technique & industrielle, vol. 2, no. 13, Oct 1920, pp. 38-44, 15 figs. Swedish machine for cold drawing of rivets, bolts, etc.

Axle Machining Equipment. Axle Machining Equipment. Engr., vol. 103, no. 3386. Nov. 19, 1920, pp. 508 and 512, 6 figs. Axle facing and centering machine and axle turning lathe exhibited at machine tool exhibition at Olympia.

Belt Drive. Group vs. Individual Drive for Machine Tools, R. F. Jones. Belting, vol. 18, no. 1, Jan. 1921, pp. 59-62, 2 figs. Group offers practically all advantages of individual and in addition first cost is much lower maintenance charges less and depreciation slower.

Developments. The Shipbuilding, Engineering and Electrical Exhibition, Kelvin Hall. Glasgow, Machy. (Lond.), vol. 17, no. 428, Dec. 9, 1920, pp. 282-285, 8 figs. Developments in machine-tool field.

Power Consumed. Influence of Shape of Chips on the Power Consumption of Machine Tools (Einfluss der Spanform auf den Kraftverbrauch von Werkzeugmaschinen), Th. Damm. Werkstattstechnik, vol. 14, no. 19, Oct. 1, 1920, pp. 507-508, 1 fig. Results of tests carried out on a planing machine, shown in table and chart.

MALLEABLE IRON

Manufacture. American Malleable Cast Iron—II. Iron Trade Rev., vol. 68, no. 3, Jan. 20, 1921, pp. 213-218, 2 figs. Developments of malleable industry in U. S.

See also Castings, Malleable.

MANGANESE STEEL

Machining. Manganese Steel and Methods of Machining It, S. A. Hand. Am. Mach., vol. 54, no. 2, Jan. 13, 1921, pp. 43-45, 3 figs. Grinding is only method of machining.

MARINE BOILERS

Electric Welding. A Revolution in Marine Boiler Construction, Francis Butt-Gow. Boiler Maker, vol. 21, no. 1, Jan. 1921, pp. 1-4, 9 figs. Electric welding of Scotch marine boilers and works of R. & W. Hawthorn-Leslie & Co., England.

Manufacture. Willamette's War Work, Fred H. Colvin. Am. Mach., vol. 54, no. 3, Jan. 20, 1921, pp. 105-107, 6 figs. Production manufacture of marine boilers.

METALS

Fatigue. The Relation of Recoverance to the Fatigue of Metals, Robert G. Guthrie. Jl. Soc. Automotive Engrs., vol. 8, no. 1, Jan. 1921, pp. 65-68, 2 figs. Description of modulimeter, an apparatus for measuring recoverance. Recoverance is capacity of material to return immediately energy that has been imparted to it by any external force.

Colloidal State. Colloidal State in Metals and Alloys, Jerome Alexander. Min. & Metallurgy, no. 166, Oct. 1920, p. 22. Physical theory of colloidal state.

METEOROLOGY

Atmospheric Pressure-Temperature Relations. The Relationship Between Pressure and Temperature at the Same Level in the Free Atmosphere. E. H. Chapman. Proc. Royal Soc. vol. 98, series A, no. A691, Dec. 3, 1920, pp. 235-248, 1 fig. Correlation coefficients between pressure and temperature at same level in free atmosphere.

METRIC SYSTEM

Adoption in U. S. A New Metric System Bill. Iron Age, vol. 106, no. 26, Dec. 23, 1920, pp. 1677. Principal features of bill introduced into Senate on Dec. 21, 1920, to establish Metric System in United States.

The Metric System Bill Introduced in the Senate, Am. Mach., vol. 53, no. 27, Dec. 30, 1920, pp. 1248-1249. Text of bill providing for compulsory use of Metric System in United States recently introduced in Senate.

MILLING

Continuous. Continuous Milling of Pump Bodies. Am. Mach., vol. 54, no. 3, Jan. 20, 1921, pp. 108-109, 5 figs. Table revolves to feed work, and castings are replaced while machine is cutting.

MILLING MACHINES

Cutter Selections. Proposals for New Factory Instruction Sheets (Entwürfe neuer Betriebsblätter), Betrieb, vol. 3, no. 4, Nov. 25, 1920, pp. 31-32 proposal of the Committee for Economic Production (AWF) for a new instruction sheet containing directions for the selection and manipulation of milling cutters.

Horizontal. Horizontal Milling Machine Eng., vol. 110, no. 2869, Dec. 24, 1920, pp. 834-836 8 figs. Single pulley type machine constructed by Alfred Herbert. Coventry, England. Pulley is mounted on ball bearings, which are fitted to fixed sleeve attached to body of machine.

Locomotive Frame. Milling Machine for Locomotive Frames, Hartwig Orenstein. Eng Progress, vol 1, no 12, Dec 1920, pp. 305-306. Three-column milling machine for milling frames having 11 meters in length, used at locomotive works in Berlin.

MINE HAULAGE

Colliery Plant. Electric Haulage and Ventilating Plant at the Easington Colliery. Eng., vol. 110, no. 2868, Dec 17, 1920, pp. 804-806 and 808, 10 figs. Various electric haulages comprise two large main-and-tail haulages of 600 hp and 450 hp., respectively, and three endless haulages, two of which are of 100 hp. and third of 85 hp.

MINERALS

Manitoba. Non-Metallic Mineral Deposits of Manitoba, D. C. McArthur. Monthly Bul. Can. Inst. Min. & Metallurgy, no. 105 Jan. 1921, pp. 48-53. Cement, gypsum, building stone lime stone and brick placed.

MOMENT OF INERTIA

Unsymmetrical Sections. Calculating the Strength of Unsymmetrical Sections, G. S. Chiles and R. G. Kelley. Machy. (N. Y.), vol. 27, no. 4, Dec. 1920, pp. 345-348. Methods of determining moment of inertia, together with formulas for obtaining section modulus and radius of gyration.

MOTOR BOATS

Engines. Commercial Motor Boats and the Diesel Engine, G. D. Cavison. Jl. Soc. Automotive Engrs., vol. 8, no. 1, Jan. 1921, pp. 46-50, 7 figs. Chart showing comparative operating costs of Diesel, hot-bulb and gas engines.

MOTOR PLOWS

Wheel Design. Plowing by Machinery (Le problème de l'adhérence), F. Mirès. Vie technique & industrielle, vol. 2, no. 15, Dec. 1920, pp. 207-211, 21 figs. Types of wheels required to develop sufficient adherence between wheels and soil. (To be continued.)

MOTOR-TRUCK TRANSPORTATION

Germany. Development of Public Motor Transport in Germany, Benno R. Dierfeld. Automotive Industries, vol. 43, no. 26, Dec. 23, 1920, pp. 1251-1254, 3 figs. Vehicles are operated in large fleets by trained staffs, service being controlled by motor transportation companies owned by local governments. Post Office Department operates passenger vehicles.

MOTOR TRUCKS

Axles. A New Dual Reduction Truck Axle, P. M. Heldt. Automotive Industries, vol. 44, no. 1, Jan. 6, 1921, pp. 10-13, 6 figs. Dual reduction axle with drop-forged housing of double banjo type.

Body-Design. Engineering Features of New British Trucks at Olympia, M. W. Bourdon. Automotive Industries, vol. 43, no. 25, Dec. 16, 1920 pp. 1207-1212, 20 figs. Careful attention to details heretofore neglected and many refinements in design feature new models. Bristol 3 to 4-ton has electric lights, new transmission and 16 in. single-plate clutch. Halley uses 6-cylinder engine, shaft brake at rear of worm and novel steering connections. Austin has only unit powerplant. Single plate clutch, propeller shaft brakes, overhead worms, plain bearing rear axles and steel wheels, generally used.

Design. The Trend of Motor Truck Design for 1921, Victor W. Page. Sci. Am., vol. 124, no 2, Jan. 8, 1921, pp. 30-31 and 38-40, 12 figs. Brief survey of features displayed by 682 American models.

German-Built. Motor Lorries, Rudolf Urtel. Eng. Progress, vol. 1, no. 12, Dec. 1920, pp 360-363, 5 figs. Survey of recent developments in Germany and record of standardization work.

Quantity Production. Fixtures for Quantity Production of Truck Parts—I. Metal Trades, vol. 11, no. 12, Dec. 1920, pp. 489-493, 8 figs. Fixtures used by Fageol Motors Co. (To be continued.)

Specifications. Complete Mechanical Specifications of all Makes of 1921 Gasoline Motor Trucks-Commercial Vehicle, vol. 23, no. 11, Jan. 1, 1921, pp. 356-378. Details of 527 gasoline, 22 electric and one steam motor truck chasis as produced by 227 American truck manufacturers.

Wheels. Machining Motor Truck Wheels. Machy. (N. Y.), vol. 27, no. 4, Dec. 1920, pp. 349-355, 15 figs. Also Machy. (Lond.), vol. 17, no. 432, Jan. 6, 1921, pp. 411-417, 15 figs. Practice of Clark Equipment Co., Buchanan, Mich., in production of steel truck wheels.

N

NAVIGATION

Hydrophone. U. S. Navy MV Type of Hydrophone as an Aid and Safeguard to Navigation, H. C. Hayes. Proc. Am. Philosophical Soc., vol. 59, no. 5, 1920, pp 371-404, 12 figs. Uses of apparatus developed during war for determining direction of submerged submarine.

NICKEL

Properties. Physical Properties of Nickel, Paul D. Merica. Chem. & Metallurgical Eng., vol. 24, no. 2, Jan 12, 1921, pp 73-76, 5 figs. Compilation of literature references and original and unpublished work on various physical, mechanical, thermal, electrical and optical properties of pure nickel.

NICKEL-CHROMIUM STEEL

Uses. Applications of Alloy Steels in Automotive Industries H. J. French. Automotive Manufacturer, vol. 62, no. 9, Dec. 1920, pp. 21-28, 9 figs. Nickel-chromium steels and their advantageous properties, especially for transmission and other gears, aeroplane and other crank-shafts, and other highly important parts.

O

OIL ENGINES

Marine. Modern Marine Oil Engines. Shipbuilding & Shipping Rec., Special Number, Jan. 5, 1921, pp. 58-60 5 figs. Survey of different types of internal-combustion engine available for propulsion of merchant ships.

Solid-Injection. The Solid-Injection Oil Engine, Edgar J. Kates. Power, vol. 52, no. 26, Dec. 28 1920, pp. 1008-1010, 3 figs. Fuel consumption test on 200-hp. solid injection oil engine.

OIL FUEL

Coal and Gas vs. Fuel Oil Power Plant Eng., vol. 25, no. 1, Jan. 1, 1921, pp. 51-55, 9 figs. Chart for determining relative costs of oil, gas and coal for equal economy.

Specifications. Specifications for Oil Fuel (Au sujet des conditions de recette des combustibles liquides), Pierre Appell. Chaleur & Industrie, no. 8, Nov.-Dec. 1920, pp. 490-495. Specifications of French and British navies and of U. S. Bureau of Mines.

Uses. Uses of Oil Fuel (Les emplois de mazout), Norbert Lallie. Vie technique et industrielle, vol. 2, nos. 13, 14 and 15, Oct., Nov. and Dec 1920, pp. 25-32, 121-125 and 217-223, 42 figs. Oct.: Industrial uses, and methods of combustion; Nov. and Dec.: Types of burners.

OILS

Slushing. Slushing Oils, Percy H. Walker and Lawrence L. Steele. Technologic Papers, Bur. of Standards, no. 176, Oct. 14, 1920, 23 pp. Desired properties of slushing oils. Laboratory tests on slushing compounds. Proposes specifications for slushing greases suitable for protection of exposed bright metal.

OXY-ACETYLENE CUTTING

Steel Plate. Cutting Steel Plate with a Torch. Gas Age, vol. 47, no. 1, Jan. 10, 1921, pp. 9-10, 2 figs. Machines for operating oxy-acetylene-cutting torch adopted to irregular surfaces and with automatic feed.

OXY-ACETYLENE WELDING

Efficiency of. Efficiency of Oxy-Acetylene Welding Benjamin Heyman. Welding Engr., vol. 5, no 12, Dec. 1920, pp. 29-32, 2 figs. Results of tests. Welding efficiency was calculated as ratio of ultimate strength of welded material in pounds per square inch and ultimate strength of unwelded material in pounds per square inch. Efficiencies thus computed varied from 77.2 to 90.5 per cent.

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PAVEMENTS, ASPHALT

Light-Traffic Streets. Experience with Surface-Treated Gravel, Light-Traffic Streets in Richmond, Ind. Mun. and County Eng., vol. 59 no. 6, Dec 1920, pp. 202-203, 1 fig. Preparation of gravel surface. Paper read before American Society for Municipal Improvements.

Rubber. Rubber as Paving Material, Francis Wood. Rubber Age, no. 10, Dec. 1920, pp. 456-457. Possibilities of rubber as road pavement.

Illinois Highway. Asphaltic Pavement Construction on an Illinois Highway and the Chicago Boulevard Link, John B. Hittell. Mun. and County Eng., vol. 59, no. 6, Dec. 1920, pp. 203-208, 1 fig. Description of two asphaltic types of construction, one with unusually rich mix in cement foundation and other with "stiff" top mixture.

Tests. Beam and Slab Tests on Pavements with Asphaltic Base, Prevost Hubbard. Can. Engr., vol. 40, no. 1, Jan. 6, 1921, pp. 113-115 2 figs. Results of impact tests on slabs. Paper read before Engrs. Club of Phila.

PAVEMENTS, BITUMINOUS

Macadam Base. Present Status of Macadam Base for Bituminous Pavements, Julius Adler. Good Roads, vol. 20, no. 19, Nov. 10, 1920, pp. 225-228 and 232. Comparative value of macadam and bituminous concrete as foundations under asphalt pavements. Paper read before American Society for Municipal Improvements.

PAVEMENTS, CONCRETE

Steel Reinforcement. Use of Steel Reinforcement for Concrete Pavements, H. Eltinge Breed. Eng. News-Rec., vol. 85, no. 26, Dec. 23, 1920, pp. 1231-1234. Design of two-layer reinforcement and specification of heavy metal.

PEAT

Briquets. Manufacture of Peat Briquet in Sweden (Möjlighet för torvbrikettfabrikation i Sverige), Alf. Larson. Teknisk Tidskrift (Veckoupplagan), vol 50, no. 42, Oct. 16, 1920, pp. 461-471, 12 figs. Made from deposits containing 50 per cent water.

PETROLEUM

Products of, Transporting. Hazards of Handling and Transporting Volatile Petroleum Products, C. P. Bowie. Reports of Investigations, Bur. of Mines, Dept. of Interior, serial no. 2195, Dec. 1920 2 pp. Experiments showed that highly explosive mixtures of hydrocarbon vapors and air are produced when mixture contains 1.4 to 6 per cent hydrocarbon vapor and dangerous flashes may be produced with mixtures containing less or more than these proportions.

Refining. Petroleum Refining Process and Problems, H. H. Hill. Jl. Soc. Automotive Engrs., vol. 8, no. 1, Jan. 1921, pp. 51-53. Common types of refining plants.

Sulphur in. Sulphur in Petroleum Oils, C. E. Waters. Technologic Papers Bur. of Standards, no. 177. Oct. 20, 1920, 26 pp., 1 fig. Theories concerning origin of sulphur and sulphur compounds which are found in crude petroleum. Tests for detection of sulphur are described and copper test is shown to be of great delicacy.

PIG-IRON

Synthetic. Furnace Earns Cost in Two Months, Herschell L. Hatt. Foundry, vol. 49, no. 1, Jan. 1, 1921, pp. 30-32, 1 fig. Experience with home-made electric furnace operated for producing synthetic pig iron from steel scrap.

PILES

Wood vs. Concrete. Wood and Concrete Piling. An Informal Discussion, Charles R. Gow, James W. Rollins, Frank W. Hodgdon, Henry F. Bryant, Wright Taussig, John T. Scully, Frederick A. Waldron and Harry E. Sawtell. Jl. Boston Soc. Civil Engrs., vol. 7, no. 10, Dec. 1920, pp. 273-299, 1 fig. Records of pile penetration, loading and best data.

PIPE, CAST IRON

Founding. Cast Iron Pipe Founding at Fort William Plant, P. R. Hurley. Can. Foundryman, vol. 12, no. 1, Jan. 1921, pp. 17-19, 4 figs. Method and equipment of manufacturing cast-iron water and gas pipe.

How Soil Pipe Castings Are Made, Pat Dwyer, Foundry, vol. 49, no. 2, Jan. 15, 1921, pp. 43-47, and 50, 7 figs. Standardized manufacturing practice at plant of Somerville Iron Works, Somerville, N.J.

PIPE, CONCRETE

Design. A New Reinforced Concrete Pipe, George C. Barthram. New England Water Works Assn., vol. 34, no. 4, Dec. 1920, pp. 312-314, 1 fig. Suggested design.

PIPE LINES

Calculation. The Scientific Calculation of Pipe Lines (Une méthode scientifique pour le calcul des pipe-lines), Vie technique & industrielle, vol. 2, no. 15, Dec. 1920, pp. 229-233, 4 figs. Equations reduced from theory of flow of fluids on solids.

Valves. Effect of Small Gate or Valve in Larger Pipe Line, T. E. Lally. New England Water Works Assn., vol. 34, no. 4, Dec. 1920, pp. 302-311, 4 figs. Tests to determine loss of pressure.

PISTONS

Aluminum-Alloys. Aluminum Alloy Pistons, Ernest V. Pannell. Metal Industry (N. Y.), vol. 19, no. 1, Jan. 1921, pp. 15-17, 8 figs. Advantages of aluminum, alloys in use, their treatment and design, and manufacture of pistons for gasoline motors.

PLANERS

Electrically-Driven. Electrically-Driven Planing Machine. Engr., vol. 130, no. 3390, Dec. 17, 1920, p. 619. Machine has stroke of 30 ft. and can accomodate work up to 12 ft. in width and 8 ft. in height. Including electrical equipment machine weight about 100 tons. Driving motor is of 70 b.hp.

Practice in Machine-Tool Plants. Production Planing in Machine Tool Plants, Edward K. Hammond. Machy. (N. Y.), vol. 27, no. 5, Jan. 1921, pp. 409-419, 15 figs. Planer practice in number of plants building milling machines.

PLATES

Stresses in. The Bending Stress of Plates Under Concentrated Loads (Die Biegungsbeanspruchung von Platten durch Einzelkräfte), A. Nadai. Schweizerische Bauzeitung, vol. 76, no. 23, Dec. 4, 1920, pp. 257-260. Stress is determined by author in and near the pressure surface of a thick circular plate bent by a single force.

POWER GENERATION

Development in 1920. Review of the Year. Power, vol. 53, no. 1, Jan. 4, 1921, pp. 2-21. Tendencies in design and practice in power plant field, and economic problems that must be met. Adoption and promulgation of A.S.M.E. boiler code. Studies of steam engine, uniflow engine and high-speed turbo-blowers. Progress in accident prevention.

POWER PLANTS

Development. Engineering Developments of 1920-21. Elec. World, vol. 77, no. 1, Jan. 1, 1921, pp. 17-38, 35 figs. Important developments are classified under (1) generation and protection; (2) transmission and distribution; (3) science and research, and (4) lighting and industrial. Recent tendencies and practices as revealed by prominent installations carried out in 1920 are studied for each one of these divisions.

POWER STATIONS

Design. Unit Idea in Power Station Design, Louis R. Lee. Elec. Ry. Jl., vol. 57, no. 2, Jan. 8, 1921, pp. 73-76, 1 fig. Application of unit principle to generating plants as a whole.

POWER TEST CODES

Reciprocating Steam Engines. *See Steam Engines, A.S.M.E. Test Code.*

POWER TRANSMISSION

Pneumatic. Essential Properties of Pneumatic Transmission in a Closed Cycle (Propriétés essentielles de transmission pneumatiques en cycle fermé), Jacques de Lassus. Comptes rendus des Séances de l'Académie des Sciences, vol. 171, no. 21, Nov. 22, 1920, pp. 992-995. Laws governing polytropic changes in cycle proposed in Comptes rendus, Nov. 8, pp. 899-901.

Power Transmission by an Invariable Mass of Gas in a Closed Space (Sur une transmission d'énergie méchanique utilisant une masse invariable de gaz en circuit fermé), Jacques de Lassus. Comptes rendus des Séances de l'Académie des Sciences, vol. 171, no. 19, Nov. 8, 1920, pp. 899-901, Adiabatic compression in a closed space.

PRESSES

20-Ton. Power Press with Pressure Range to 20 Tons. Iron Age, vol. 107, no. 2, Jan. 13, 1921, p. 140, 1 fig. Pressure exerted upon work ranges from few pounds to 20 tons and is applied by operator on foot pedal.

PRESSWORK

Electric Motor Plant. Press Work in an Electric Motor Plant—II. Machy. (N. Y.), vol. 27, no. 4, Dec. 1920, pp. 340-344, 11 figs. Methods used in Power Press Department of General Electric Co., Lynn, Mass.

PROFIT SHARING

England. Teaching Workers to Think "Production," Cecil Chisholm. Factory, vol. 26, no. 1, Jan. 1 1921, pp. 40-42. Experience in English works with profit-sharing systems.

PUBLIC UTILITIES

Service at Cost. Service at Cost Agreements. Aera, vol. 9, no. 6, Jan. 1921, pp. 599-607. Analysis of various ordinances which are now in effect in American cities, particularly provisions by which fares are made to respond to expenses.

PULVERIZED COAL

Advantages. Pulverized Coal, Power Plant Eng., vol. 25, no. 1, Jan. 1, 1921, pp. 56-60, 9 figs. Graph showing comparative heat values for various fuels. *See also Steel Castings, Annealing.*

PUMPS, CENTRIFUGAL

Induction Motors for. Variables Speed Induction Motors for Centrifugal Pumps. Eng. News-Rec., vol. 85, no. 24, Dec. 9, 1920, pp. 1126-1127, 3 figs. Comparison of overall efficiencies for centrifugal unit, based on tests on motor-driven three-stage pump run at normal speed throttled or variable speeds unthrottled.

Turbine. New Contributions to the Theory of Side Thrust, Side-Thrust Equalizing Devices and Clearance Losses in Turbine Pumps (Neue Beiträge zur Theorie des Achsschubes, der Achsschubaus-gleichsvorrichtungen und Spaltverluste in Turbinenpumpen), L. W. Weil. Zeit, für das gesamte Turbinenwesen, vol. 17, nos. 25, 26, 28, 30 and 31 Sept. 10, 20, Oct. 10, 30 and Nov. 10, 1920, pp. 289-294, 301-307, 331-335, 356-358 and 369-372, 28 figs. Describes theoretically developed, practical and useful methods for calculation of side-thrust forces in turbine pumps and arrangements for combating them.

R

RADIO COMMUNICATION

Developments. Wireless Telegraphy and Telephony, Alan A. Campbell Swinton. Engr., vol. 130, no. 3389, Dec. 10, 1920, pp. 592-594, 7 figs. Survey of developments. Address before Royal Soc. of Arts.

RAILS

Failure. Rail Failure Statistics for 1919, M. H. Wickhorst. Bul. Am. Ry. Eng. Assn., vol. 22, no. 229, Sept. 1920, pp. 47-87. Statistics of rail failure collected for year ending Oct. 21, 1919, furnished by railroads of United States and Canada, in response to circular sent out by American Railroad Association.

Flat-Bottom vs. Bull-Head. The Case of the Bull-Head Rail. Ry. Gaz., vol. 33, no. 23, Dec. 3, 1920, pp. 736-737. Comparison of relative advantages of flat-bottom and bull-head rails for railway track purposes.

RAILWAY CONSTRUCTION

Economics. Reeders for Railroads, Charles A. Morse. Mech. Eng., vol. 43, no. 1, Jan. 1921, pp. 19-20. Economical factors involved in construction of branch lines.

RAILWAY ELECTRIFICATION

Canada. Electrical Operation on the Canadian National. Ry. Elec. Engr., vol. 12, no. 1, Jan. 1921, pp. 25-29, 9 figs. Modification of original plan as result of amalgamation of Canadian Northern with Government railways.

Chicago. Chicago Electrification and Elevation C. M. & St. P. Ry. Eng. News-Rec., vol. 85, no. 26, Dec. 23, 1920, pp. 1226-1230, 9 figs. Third-rail passenger and trolley freight service on Evanston suburban line. Concrete walls and trestle. Precast and poured bridge decks.

European Developments. Status of Heavy Traction Abroad. Elec. Ry. Jl., vol. 57, no. 1, Jan. 1, 1921, pp. 31-36. Survey of practice in Great Britain colonies and Continental Europe.

France. Partial Electrification of the French Railways (Électrification partielle des Chemins de fer français), A. Fretel. Electricien, vol. 36, no. 1265, Dec. 1, 1920, pp. 505-514. Progress in carrying out projects for electrification of three of principal French railways.

India. The Electrification of Indian Railways. Engr., vol. 130, nos. 3387-3388, Nov. 26-Dec. 3, 1920, pp. 530-531, 3 figs., 550-551, 4 figs. Comparative performance of electric and steam locomotives of Indiana Northwestern Railway.

Operating Results from. The Electrification of Steam Railroads. Ry. Age, vol. 70, no. 1, Jan. 7, 1921, pp. 101-106, 8 figs. Brief survey of operating results on Norfolk & Western and C. M. & St. P.

Tunnels. New Catenary Construction for the Hoosac Tunnel. Ry. Elec. Engr., vol. 12, no. 1, Jan. 1921, pp. 17-20, 6 figs. Tunnel is 4¾ miles in length, being longest in U. S. Renewal of overhead equipment under traffic.

St. Clair Tunnel Operation Most Successful, R. L. Herman. Ry. Elec. Engr., vol. 12, no. 1, Jan. 1921, pp. 21-24, 6 figs. Grand trunk electrical installation. Tunnel is single-track tube 6032 ft. in length with approaches totalling 5603 ft.

Sweden. The Electrification of the Swedish State Railroads (Die Elektrisierung der schwedischen Staatsbahnen), Axel F. Enstrom, Emil Alm and Carl A. Rossander. Elektrotechnische Zeit., vol. 41, nos. 45 and 46, Nov. 11 and 18, 1920, pp. 893-896 and 913-916. Expert testimony of a commission appointed by the Royal Swedish State Railroad Administration setting forth relative merits of directcurrent and single-phase alternating current. For the section Gothenburg-Stockholm preference is given to the single-phase alternating current, and it is recommended that motive power be generated in part directly in power station and in part through conversion from three-phase current at one or a few points.

Switzerland. Electrification of the Sion-Lausanne Lines of the Swiss Federal Railways (Électrification de la ligne Sion-Lausanne des C. F. F.). Bulletin Technique de la suisse romande, vol. 46, no. 24, Nov. 27, 1920, pp. 277-278. Details of project.

The Electrification of the Swiss Railways (L'électrification des chemins de fer Rhétiques), H. Lang. Bulletin technique de la Suisse romande, vol. 46, no. 25, Dec. 11, 1920, pp. 289-294, 9 figs. Single-phase system at 10,000-volts and 16⅔ periods per second has been decided upon.

RAILWAY SIGNALING

Block System. Absolute Block-System with Closed Sections Worked by Means of the Telephone on the Belgian State Railways, L. Weissenbruch and J. Verdeyen. Bul. Int. Ry. Assn., vol. 2, no. 12, Dec. 1920, pp. 878-888. Records of operation.

RAPID TRANSIT

New York City. Functions of Rapid Transit Lines in Cities, Henry M. Brinckerhoff. Eng. News-Rec., vol. 85, no. 26, Dec. 23, 1920, pp. 1235-1239, 1 fig. Capabilities of subways, elevated railways and surface lines compared from statistical records of New York City.

REACTORS

Current-Limiting. Three-Phase Current Limiting Reactors, M. E. Skinner. Elec. Jl., vol. 18, no. 1, Jan. 1921, pp. 23-25, 8 figs. Sphere of application.

REFRIGERATING PLANTS

Gas Power for. Gas Power for Refrigerating Plants, Geo. H. Trout. Ice & Refrigeration, vol. 60, no. 1, Jan. 1921, pp. 9-10. Cost of operation. Advantages of gas power.

Packing Plants. New Armour Plant at Kansas City. Power, vol. 52, no. 25, Dec. 21, 1920, pp. 966-969, 5 figs. Horizontal ammonia compressor of 500-ton capacity and generating units with mixed-pressure turbines of extraction type.

Safety Regulations. Safety Regulations for Refrigerating Plants, G. H. Crawford. Power, vol. 53, no. 1, Jan. 4, 1921, pp. 28-30, 7 figs. Study of regulations of various cities and states.

REFRIGERATION

Fish. Fish Research Committee. Interim Report on Its Investigations. Cold Storage, vol. 23, no. 273, Dec. 16, 1920, pp. 310-312, 1 fig. Suggested model low-temperature brine-freezing fish tank.

Standard Ton. Standard Ton of Refrigeration, F. E. Matthews. Refrig. World, vol. 56, no. 1, Jan. 1921, pp. 16-17. It has been defined by adoption of recommendations of special committee by Am. Soc. Refrigerating Engrs. at 288,000 B.t.u.

RESEARCH

Developments in. 1920; A Retrospect. Chem. Age (Lond.), vol. 4, no. 81, Jan. 1, 1921, pp. 4-6. Developments in research, industry and invention.

Engineering Foundation. Engineering Foundation: Its Work and Needs, Alfred D. Flinn. Min. & Sci. Press, vol. 122, no. 3, Jan. 15, 1921, pp. 86-87. Advisability of establishment by Engineering Foundation of Engineering Research Institute and Laboratory.

Industrial Associations. Industrial Research Associations—IV, Arnold Frobisher. Nature (Lond.), vol. 106, no. 2666, Dec. 2, 1920, pp. 443-446. British Research Association for woollen and worsted industries.

Industrial Research Associations—V, S. G. S. Panisset. Nature (Lond.), vol. 106, no. 2667, Dec. 9, 1920, pp. 475-476. British Portland Cement Research Association.

Industrial Research Associations—VII, H. S. Rowell. Nature (Lond.), vol. 106, no. 2669, Dec. 23, 1920, pp. 538-540. Research Association of British motor and allied manufacturers.

Lumber Industry. Research and Boards, Ovid M. Butler. Sci. Am. Monthly, vol. 3, no. 1, Jan. 1921, pp. 59-62, 6 figs. Need of establishing laboratories to study problems of lumber industry.

Machinery. Complete Laboratory for Research in Machinery. Iron Trade Rev., vol. 68, no. 2, Jan. 13, 1921, pp. 152-153, 1 figs. Research laboratory of National Lamp Works of General Electric Co., Cleveland installed to test and to study further development of machines used in manufacture of lamps.

Paper. Progress of U. S. Paper Laboratory in 1920. Paper, vol. 27, no. 18, Jan. 5, 1921, pp. 14-16. Important work has been done on paper-testing machines, paper substitutes, determination of sizing, quality of paper, fibre studies, etc.

RESERVOIRS

Evaporation. Figuring Evaporation from Temperature Records, C. E. Grunsky. Jl. Electricity, vol. 46, no. 1, Jan. 1, 1921, pp. 23-26, 5 figs. Theory is offered that evaporation, taken in its yearly average, is directly proportional to temperature, and empirical formula is derived for calculating anticipated evaporation for any given reservoir site.

RIVETS

Heating by Electricity. Heating Rivets by Electricity, J. R. Bower. Jl. Engrs. Club of Phila., vol. 38-1, no. 193, Jan. 1921, pp. 1-7, 14 figs. Principle of operation and details of construction of electric rivet heater. Comparison of heating rivets by electricity with other methods of heating.

Standards. Report of the German Industry Committee on Standards (N. D. I.) (Mitteilungen des Normenausschusses der Deutschen Industrie). Betrieb, vol. 3, no. 5, Dec. 10, 1920, pp. 69-81, 14 figs. Proposals of the Board of Directors for round-head rivets for boiler and steel construction, symbols for rivets and screws in iron structures; countersunk-head rivets, etc. Proposed standards for concrete boundary and milestones; drain-pipe laterals; sheet-metal rivets; rules of the Committee for Units and Formular Values (AEF).

ROAD CONSTRUCTION

Saskatchewan. Present and Future Development of Road Work in Saskatchewan. Can. Engr., vol. 40, no. 2, Jan. 13, 1921, pp. 131-134, 1 fig. System is over 7,160 miles long.

Methods of Construction. Modern Concrete Road Construction: Machinery and Methods, George A. Sherron. Proc. Engrs. Soc. Western Pennsylvania, vol. 36, no. 8, Nov. 1920, pp. 519-529 and (discussion) pp. 530-538. Considerations of selection of equipment.

Operation. Practical Pointers on Rolling Mill Operation, W. S. Standiford. Can. Machy., vol. 24, no. 26, Dec. 23, 1920, pp. 555-558, 2 figs. Comparison of English and American methods of rolling.

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SAFETY

Compressed-Air Work. Revised Rules on Compressed-Air Work in New York. Eng. News-Rec., vol. 85, no. 26, Dec. 23, 1920, p. 1225. Conference of engineers, contractors, workmen and state department adopts measures for safety of men and work.

Industrial. Securing Safety Through Competition. Iron Age, vol. 106, no. 26, Dec. 23, 1920, p. 1679, 1 fig. Plan of Dedge Mfg. Co. consists in distributing small cash prizes to workers and arousing competition in departments.

Standards. Safety Standards of the Industrial Board. Commonwealth of Pennsylvania, Dept. of Labor & Industry, vol. 1, no. 4, 9 pp. Railings, toe boards, platforms and runways.

SAND BLAST

Apparatus. Sand-Blasting, C. W. Starker. Machy. (N. Y.), vol. 27, no. 5, Jan. 1921, pp. 458-462, 11 figs. Types of apparatus, abrasives, nozzles, air pressures, dust exhausting, etc.

SANITATION

New York City. Water Supply and Sanitation in the Metropolitan District of New York and New Jersey, George A. Soper, George C. Whipple, Allen Hazen, J. T. Fetherston. Eng. News-Rec., vol. 86, no. 3, Jan. 20, 1921, pp. 104-107. Deals with water supply, sewerage, refuse disposal and snow removal. Discussion before New York Section of Am. Soc. Civil Engrs.

SCIENTIFIC INSTRUMENTS

Manufacture. Operations in the Manufacture of Scientific and Optical Insturments—I, Machy. (Lond.), vol. 17, no. 431, Dec. 30, 1920, pp. 389-395, 13 figs. Works of T. Cooke & Sons, York, England.

SCIENTIFIC MANAGEMENT

See Industrial Management.

SCREW MACHINES

Circular Forming Tools. Design of Circular Forming Tools Earl H. Smiley and J. H. Davis. Machy. (N. Y.), vol. 27, no. 4, Dec. 1920, pp. 366-369, 6 figs. Calculations for designing circular forming tools having top rake.

SCREW THREADS

Milling Side-Cutting of Hobs. Side-Cutting of Thread-Miming Hobs, Earle Buckingham. Mech. Eng., vol. 43, no. 1, Jan. 1921, pp. 9-11 and 62, 5 figs. Mathematical study of side-cutting action of hob. Corrections in form of thread-milling hobs to produce threads sufficiently correct as to form for all practical purposes are pointed out.

SCREWS

Optical Work. Cutting and Gaging Screws. Machy. (Lond.), vol. 17, no. 428, Dec. 9, 1920, pp. 286-288, 4 figs. Method used by Taylor, Taylor & Hobson, Leicester, England. Table of tolerances for screw gages for optical work. Report of Committee of Department of Scientific and Industrial Research on Standardization of Elements of Pptical Instruments.

Standards. Report of the German Industry Committee on Standards (Mitteilungen des Normenausschusses der Deutschen Industrie). Betrieb, vol. 3, nos. 3 and 4, Nov. 10 and 25, 1920, pp. 29-40 and 49-62, 31 figs. Nov. 10: Proposals of Board of Directors for square washers for channels and I-beams. Proposed new standards for Whitworth fine thread, metric fine thread, and sizes for paper sheets; Nov. 25: Proposals for Whitworth pipe threads; lock washer; square washers for wooden joints; knob screws and nuts. Proposed standards for set screws and of screws with slotted heads, set screws; metric extra-fine thread.

SEMI-STEEL CASTINGS

Experiments. Remarks on Semi-Steel Castings (Remarque sur la fonte aciérée). Fonderie Moderne, no. 11, Nov. 1920, p. 262. Experimental study of casting temperature.

SEWAGE DISPOSAL

Activated Sludge. Activated Sludge Experiments in England. Public Works, vol. 49, no. 25, Dec. 18, 1920, pp. 567-569. Conducted at Stoke-on-Trent during past two years, dealing with waste water from potteries.

Experiments with Modified Activated Sludge Process at Mount Vernon, N.Y. Eng. & Contracting, vol. 55, no. 2, Jan. 12, 1921, pp. 31-32, 2 figs. Dorr-Peck activated sludge tank. Paper presented before Sanitary Section Boston Society of Civil Engineers.

Test of Trent Activated-Sludge Devices at Pasadena, R. V. Orbison. Eng. News-Rec., vol. 85, no. 27, Dec. 30, 1920, pp. 1286-1288, 4 figs. Tests of activated-sludge plant in which aeration and agitation are effected by pumping sewage and air into bottom of activation tank, distribution being through revolving perforated arms on Barker mill or revolving lawn sprinkler principle.

Dorr-System. Treating Sewage by the Dorr System. Public Works, vol. 50, no. 3, Jan. 15, 1921, pp. 52-56, 6 figs. Sedimentation secured by radial surface flow, and continuous removal of sludge revolving plows. Description of Mt. Vernon plant, containing special type of screen and of activated sludge apparatus, which gave unusual efficiency of air used.

Tidal Water. Design of a Sewage Disposal Scheme for a City Located on Tidal Waters, C. J. Yorath. Jl. Eng. Inst. Canada, vol. 4, no. 1, Jan. 1921, pp. 1-8, 1 fig. Consideration of problems encountered for typical city on tidal waters, calculations of dry-weather and storm flow; hydraulic design of necessary sewers and pumping station.

SHAFT HANGERS

Reinforced-Concrete Plants. Securing Shaft Hangers to Beams in Reinforced Concrete Plants, S. R. Stone. Belting, vol. 18, no. 1, Jan. 1921, pp. 32-38, 15 figs. Providing for expansion of departments or changes. Preplanning necessary to avoid alterations. Sleeved slits for belt drives between floors.

SHAFTS

Whirling Speeds. The Transverse Vibrations of Beams and the Whirling of Shafts Supported at Intermediate Points, E. R. Darnley. Lond., Edinburgh & Dublin Phil. Mag., vol. 41, no. 241, Jan. 1921, pp. 81-96, 1 fig. Equations giving periods of transverse vibrations of uniform beams and whirling speeds of uniform shafts, when beams or shafts are simply supported at any number of intermediate points.

SHIP SALVAGE

Dredger. The Salvage of the Dredger "Silurus." Eng., vol. 111, no. 2871, Jan. 7, 1921, pp. 5-8, 11 figs. Vessel was 260 ft. by 46 ft. by 20 ft. She rested on her port bulwarks and top of port sheerstrake and with part of her funnel embedded in mud about 54 ft. below water level. Detailed account of salvage work. (To be continued.)

SHRINKAGE

Stresses in. Shrinkage Stresses in Hubs, Rings, Cranks, etc. (Strumpfspannungen in Naben, Ringen, Kurbelarmen, etc.), Karl Stösser. Der praktische Maskinen-Konstrukteur, vol. 35, nos. 41-42, Oct. 14, 1920, pp. 353-359, 6 figs. Describes method for approximate determination of shrinkage stresses resulting from the hot and cold fitting of crank arms, hubs, rings, etc., to shafts; the stresses fire shown graphically and an example is given.

SNOW REMOVAL

Country Roads. Snow Removal from Country Roads. Public Works, vol. 50, no. 3, Jan. 15, 1921, pp 60-63, 4 figs. Methods employed last winter and adopted for this one in Pennsylvania, Indiana, Michigan, Illinois, New Jersey. Massachusetts, Connecticut, Maryland and New York. Preventive methods, including snow fences. Methods of handling snow.

SPRINGS

Helical. Chart and Simplified Formulæ for Helical Springs of Tempered Steel. Machy. (Lond.), vol. 17, no. 429, Dec. 16, 1920, pp. 318-319, 1 fig. Chart for determining carrying capacity, deflection and dimensions of tempered steel helical springs, tension or compression.

STANDARDIZATION

System of Fit Allowances. A System of Fit Allowances, Sydney B. Austin. Machy. (N. Y.), vol. 27, no. 5, Jan. 1921, pp. 452-454, 3 figs. Curves showing relation of allowances for fits to various diameters. Comparison of theoretical curves with B. & S. system of fit allowances and with Newall Engineering Co.'s system of fits.

STEAM-ELECTRIC PLANTS

Design. Tendencies in the Design of Power Stations, Peter Junkersfeld. Elec. World, vol. 77, no. 1, Jan. 1, 1921, pp. 5-7, 5 figs. Economies resulting from skillful arrangement of station and layout of equipment and operating tendencies in boiler and turbine rooms. Survey of principal achievements in 1920.

STEAM ENGINES

A. S. M. E. Test Codes. Power Test Codes. Mech. Eng., vol. 43, no. 1, Jan. 1921, pp. 32-36, 1 fig. Preliminary draft of test code for reciprocating steam engines, formulated by Am. Soc. Mech. Engr. Test Code Committee.

STEAM TURBINES

Lubrication. The Lubrication of Steam Turbines (La lubrification et le système de graissage des turbines à vapeur), C. P. Roux. Revue générale de l'Electricité, vol. 8, no. 25, Dec. 18, 1920, pp. 870-872, 1 fig. Suggested specifications for oils and greases.

Small Machines. Small Steam Turbines, W. J. A. London. Proc. Engrs. Soc. Western Pennsylvania, vol. 36, no. 8, Nov. 1920, pp. 539-564 and (discussion) pp. 565-573, 15 figs. Study of reliability, simplicity, cost and efficiency. Turbines considered are those having output of from 5 to 300 hp.

STEEL

Defects. Defects Arising in Steel During Fabrication, Austin B. Wilson. Chem. & Metallurgical Eng., vol. 23, no. 25, Dec. 22, 1920, pp. 1209-1213, 24 figs. Microscopic appearances caused by surface defects, cold-working, overheating, and burning. Nuclei of fatigue fractures are associated with phosphorus bands. Photographs of changes in structure during annealing of steel castings are also given.

Manganese. *See Manganese Steel.*

Nickel. *See Nickel Steel.*

Nickel-Chromium. *See Nickel-Chromium Steel.*

Research. Research on Steel Conducted in Germany During the War (Etudes faites en Allemagne durant la guerre, sur la connaissance des aciers), Gaston Paris. Chaleur et Industrie, no. 7, Oct. 1920, pp. 408-418, 10 figs. Influence of chemical composition and mechanical properties. Graphs showing properties of specimens subjected to different treatments.

Shock Values After Heat Treatment. Comparative Shock Values of Steel After Varied Heat Treatments, F. C. Langenberg and J. F. Fetterely. Army Ordnance, vol. 1, no. 2, Sept.-Oct. 1920, pp. 99-100. Results of test.

Structural. *See Structural Steel.*

Welding. The Welding of Steel in Relation to the Occurrence of Pipe, Blowholes and Segregates in Ingots, Harry Brearley. Iron & Coal Trade Rev., vol. 101, no. 2755, Dec. 17, 1920, pp. 821-822. Experimental studies. Paper read before Cleveland Instn. Engrs.

STEEL CASTINGS

Annealing. Anneal Steel with Pulverized Coal, C. H. Gale. Foundry, vol. 49, no. 1, Jan. 1, 1921, p. 29, 4 figs. Results of annealing steel castings with pulverized coal. Paper read before Am. Foundrymen's Assn.

Strength. Steel Castings of High Strength and Toughness—I, Frederico Giolitti. Chem. & Metallurgical Eng., vol. 24, no. 3, Jan. 19, 1921, pp. 113-118, 22 figs. Data on improvement to be expected after property heat-treating steel castings, with illustrative tests on strong, tough castings which have replaced forgings on gun mounts. Advance copy of chapter of forthcoming book entitled. "Heat Treatment of Soft and Medium Streets."

STEEL MANUFACTURE

Electric-Furnace. Heat Modifies Acid Furnace Reaction, James W. Galvin and Charles N. Ring. Foundry, vol. 49, no. 2, Jan. 15, 1921, pp. 72-74. Electric furnace develops such high temperatures that chemical affinities in still are reversed. Steep sides with deep bath increase melting efficiency and compact charge is advocated.

STEEL WORKS

Coal Consumption. Coal Consumption in Steel Metallurgy (La consommation de charbon dans la grosse métallurgie). Génie Civil, vol. 77, no. 25, Dec. 18, 1920, pp. 499-503. Records of coal consumption of steel works producing 300,000 tons per year.

Two-Shift vs. Three-Shift System. The Three-Shift System in the Steel Industry, Horace B. Drury. Indus. Management, vol. 61, no. 1, Jan. 1, 1921, pp. 63-68, 5 figs. Survey of adoption of three-shift system in European countries, and account of its operation in about 20 American plaus where it has been adopted. Paper read before Taylor Society.

STREET RAILWAYS

Brakes. *See Brakes, Street-Car.*

STRESSES

Determining of Polarized Light. Determining Stresses by Polarized Light, George Weed Hall and Arthur L. Kimball, Jr. Sci. Am. Montyly, vol. 3, no. 1, Jan. 1921, pp. 49-53, 7 figs. Apparatus which permits visualization of stress distribution.

Stress Determination by Means of the Coker Photo-Elastic Method, A. L. Kimball, Jr. Gen. Elec. Rev., vol. 24, no. 1, Jan. 1921, pp. 73-81, 13 figs. Optical system for determining stress by polarized light.

Safe Loads. Chart for Determining Safe Loads, J. H. Conway. Am Mach., vol. 53, no. 27, Dec. 30, 1921, pp. 1241-1342. Chart for determining safe load for parts in tension, compression and shear where part does not exceed in length, ten times its diameter. Chart is based upon formula for determining safe load in different materials.

Study of. Plane Stress and Plane Strain in Bipolar Co-Ordinates, G. B. Jeffery. Philosophical Trans. Royal Soc. Lond., vol. 221, series A. Aug. 11, 1920, pp. 265-293, 4 figs. Mathematical study.

STRUCTURAL STEEL

Specifications. Belgian Standard Specification for Structural Steelwork. Eng. News-Rec., vol. 86, no. 2, Jan. 13, 1921, pp. 71-72. Specifications for design and fabrication of steelwork for buildings and miscellaneous steel structures adopted by Belgian Standards Association.

SWITCHBOARDS

Relay Connections. Typical Relay Connections, Lewis A. Terven. Elec. Jl., vol. 18, no. 1, Jan. 1921, pp. 29-32, 4 figs. Survey of up-to-date switchboard practice.

T

TARGET

Tower, for Battleships. *See Warships, Towing Target.*

TERMINALS, RAILWAYS

Management. Utilizing Motive Power on the Lines of the Delaware & Hudson. Ry. Rev., vol. 67, no. 26, Dec. 25, 1920, pp. 961-967. Methods of terminal management.

Operation. Railway Terminals and Terminal Yards, William Barclay Parsons. Mech. Eng., vol. 43, no. 1, Jan. 1921, pp. 21 and 62. Cost of terminal operation and possibilities of reducing it.

TESTS AND TESTING

Flexure. An Apparatus for Delicate Flexure Tests and Some Results of Such Tests, W. J. Francke. Am. Mach., vol. 54, no. 2, Jan. 13, 1921, pp. 48-52, 5 figs. Appatarus designed to test thin, tempered strip-steel shims used in flexible couplings. Paper read before Am. Soc. for Testing Matls.

Million-Pound Machine. Million Pound Testing Machine for Forest Products Laboratory, L. J. Markwardt. Eng. News-Rec., vol 86, no. 1, Jan. 6, 1921, pp. 31-32, 2 figs. Machine is of two-screw type and has overall height of 45 ft., including superstructure above weighing platform, which will enable it to accommodate columns up to 30 ft. or tension members up to 27 ft. in length.

Motion Pictures, Use in. Motion Pictures in Physical Testing Laboratory, H. J. French. Chem. & Metallurgical Eng., vol. 24, no. 3, Jan. 19, 1921, p. 131, 4 figs. Application of moving-picture camera to testing of materials.

Notched-Bar Tests. Experimental Study of Notched-Bar Impact Test (Etude expérimentale sur les essais au choc des barreaux entaillés), M. André Cornu-Thénard. Revue de Métallurgie, vol. 17, no. 10, Oct. 1920, pp. 648-667, 6 figs. Case of extra-mild steel crystallyzed in large drains Photomicrographs. (Concluded.)

Photo-Elastic Testing. Photo-Elasticity for Engineers—III, E. G. Coker. Gen. Elec. Rev., vol. 24, no. 1, Jan. 1921, pp. 82-88, 10 figs. Discussion of photo-elastic investigation of testing materials in tension. It is shown that if enlarged ends of test bar are connected with parallel part by arcs of circle stress near joint of arc with parallel portion is somewhat greater than that in parallel portion.

Radiology. Radiology Applied to the Testing of Materials, A. P. M. Fleming and J. R. Clarke. Eng., vol. 110, no. 2869, Dec. 24, 1920, pp. 850-852, 9 figs. Extent to which radiology can be used in testing materials, limitations of method as far as it has already progressed and suggestions in regard to possible lines of advancement. (To be continued.) Paper read before Manchester Assn. Engrs.

Shock. Shock Tests and Their Standardization, Robert Abbott Hadfield. Eng., vol. 110, no. 2868, Dec. 17, 1920, p. 806. Based on experimental data and results of research at Hadfield works, Sheffield. Effect of high velocities on impact up to 2870 ft. per sec. is included. (Abstract.) Paper read before Instn. Civil Engrs.

Tenacity and Elasticity. A New Process for the Determination of the Tenacity and Elasticity of Metals and Alloys (Ueber ein neues Verfahren zur Bestimmung der Schmeidigkeit von Metallen und Legierungen), P. Ludwik. Stahl u. Eisen. vol. 40, no. 46, Nov. 18, 1920, pp. 1547-1551, 4 figs. Method is described of obtaining approximate value of tenacity and elasticity without the necessity of preparing a trial bar.

Tension. Tension Tests of Materials, E. G. Coker. Eng., vol. 111, no. 2871, Jan. 7, 1921, pp. 1-4, 18 figs., partly on supp. plate. Their universality and value and best method of conducting them.

TIDAL POWER

Development. Tidal Power Development, A. H Gibson. Eng., vol 110, nos. 2867-2868. Dec. 10-17, 1920, pp 778-780, 6 figs., and 793-795, 11 figs Outline of more promising schemes which have been suggested and patented.

Utilization of. Blue Coal (La houille bleue), R. Gouedard. Vie technique & industrielle, vol. 2, no. 13, Oct 1920, pp. 17-24, 8 figs. Scheme for utilization of tidal power by means of low-head turbines. (Concluded.)

Report on Tidal Power, Engr., vol. 130, no. 3390, Dec. 17, 1920, pp. 614-615. Third interim report of Water Power Resources Committee appointed by British Board of Trade. Discussion of question of tidal power, with reference to project for utilizing 500,000 hp. of tidal energy in estuary of Severn River.

Studies in Tidal Power, Norman Davey. Engr., vol. 130, nos. 3388-3392, Dec. 3, 10, 17, 24 and 31, 1920 pp. 556-558, 578-580, 603-604, 634-636, and 652-654, 25 figs. Dec. 3: Classification and study of systems for conservation and use of tidal power; Dec. 10: Quantitative estimate of tide power cycles; Dec. 17: Analysis made of gross power available from tides under various systems of working, and change in this power factor examined under variations in tidal range; Dec. 24: Survey of tidal power available in England, and Dec. 31: Minimum constant hp. available from tides in England and Scotland is computed at 489,000 hp.; this value rising during springs to 1,555,000 hp. Gross totals of intermittent power are, minimum during neaps, 3,550,000 hp. and during springs, 15,300,000 hp.

Tidal Hydro-Electric Scheme for the Severn Engr., vol. 130, no. 3388, Dec. 3, 1920, pp. 562-563, 1 fig Discussion of scheme formulated by Civil Engineering Department of Ministry of Transport.

Utilization of Tidal Power and Energy of Wave Impact (Utilisation de la force des marées et du choc des vagues de la mer), H Parenty and G Vandamme. Comptes rendus des Séances de l'Académie des Sciences, vol. 171, no 19, Nov. 8, 1920, pp. 896-898, 2 figs. Cement structure containing parallel cells along coastal region subjected to ebb and flow. Impact of water in cells compresses air in tanks behind cement structure.

Utilization of Tidal Power on the Coast of France (De l'utilisation des courants de marée sur les côtes de France), M. La Porte. Comptes rendus des Séances de l'Académie des Sciences, vol. 171, no. 24, Dec 13, 1920, pp. 1205-1207. Study of points where utilization is most practicable.

TIME STUDY

Machining Operations. Determination of the Time Required for Machining Operations (Bestimmung der Arbeitszeiten für die Vorkalkulation im Maschinenbau), H. Eipel. Motorwagen, vol. 23, nos. 22 and 23, Aug. 10 and 20, 1920, pp. 409-413, 23 figs., 4 on 2 supp. plates. Calculating charts for determining time employed in turning and grinding drilling and cutting thread, planing and slotting and milling and sawing.

TINNING MACHINES

Thomas Automatic. Tinning Methods and Tin House Equipment, Clement F. Poppleton. Iron Age, vol. 107, no. 3, Jan. 20, 1921, pp. 187-191, 11 figs. Machine automatically feeds, pickles and polishes four plates at once. Plates travel straight forward throughout process.

TOOLS

Electric Hammer. A New Electric Combination Tool. Pacific Mar. Rev., vol. 18, no. 1, Jan. 1921, p. 69, 2 figs. Electric steel hammer manufactured by Electric Steel Hammer Co., Seattle, Wash. Tool can be arranged also as drill, grinder or chisel.

TRACTOR ENGINES

Manufacture. Methods in a Tractor Engine Plant, Machy. (N. Y.), vol. 27, no. 5, Jan. 1921, pp. 424-427, 9 figs. Special machinery and unusual equipments for standard machine tools.

TRACTORS

Tests. More Results of Tractor Tests at Nebraska, Automotive Industries, vol. 43, no. 27, Dec. 30, 1920, pp. 1306-1308. Of Sixty-six tractors tested, eight have increased their rated engine speed, six lowered their horsepower rating, fourteen changed some item of equipment and three have withdrawn.

TRANSFORMATION

Autotransformers. Phase Transformation with Autotransformers, E. P. Wimmer. Elec. Jl., vol. 18, no. 1, Jan. 1921, pp. 15-16, 7 figs. Transforming from three-phase to two-phase with Scott-connected autotransformers. Electric schemes, formulæ and graphs.

TRANSPORTATION

Coal Industry. The Transportation Problem in the Coal Industry, A. G. Gutheim. Ry. Age, vol. 69, no. 27, Dec. 31, 1920, pp. 1149-1152. Remarks of experience during war period.

Conditions in U. S. The New Era of Railroad Transportation in America, Lewis J. Spence. Ry. Age, vol. 69, no. 27, Dec. 31, 1920, pp 1153-1154. Importance, both to carriers and shippers, of maintaining spirit of friendly co-operation. Paper read before National Industrial Traffic League.

Inland Waterways. Some Inland Waterway Transportation Problems, V. E. Lacy. Jl. Soc. Automotive Engrs., vol. 8, no. 1, Jan. 1921, pp. 59-62, 5 figs. Motive power for canal traction.

Railways. Railroad Transportation. Daniel E. Willard. Mech. Eng., vol. 43, no. 1, Jan. 1921, pp. 17-18. Fundamentals for developing a complete and well-articulated national transportation system.

V

VALVES

Globe. Use and Abuse of Globe Valves. Ry. Rev., vol. 25, no. 67, Dec. 18, 1920, pp. 946-948, 2 figs. Recommends that railroads select one make of valve as standard for all their uses and maintain special globe valve repair and testing service.

Power Plants. Valves for Inconvenient Locations, Charles L. Hubbard. Power Plant Eng., vol. 25, no. 2, Jan 15, 1921, pp. 111-115, 19 figs. Methods of reaching and operating in power plants.

VENTILATION

Ventilators. Recent Tests on Automatic Ventilators, A. J. Mack. Jl. Am. Soc. Heat. & Vent., Engrs., vol. 26, no. 9, Dec. 1920, pp. 849-853, 3 figs. Tests conducted by Engineering Experiment Station of Kansas State Agricultural College upon different types of ventilators. Effectiveness of different types when operated under varying conditions was studied, and comparative tests were made on syphon ventilator and those types not intended to produce any syphoning action.

VIBRATIONS

Study. The Photo-Radiograph, A. C Banfield. Sci. Am. Monthly, vol. 3, no. 1, Jan. 1921, pp. 44-45, 6 figs. Insturment for study of vibrations.

VOCATIONAL EDUCATION

Psychological Tests. A report on the Administration of the Thurstone Engineering Aptitude Test to 800 Students in the College of Engineering of the University of Illinois. Eng. Education, vol. 11, no. 4, Dec. 1920, pp. 182-200, 5 figs. Comparison of aptitude test with army intelligence test showed that the former is better measure of probable success of students in engineering courses and is also very discriminating in upper and lower regions of ability.

W

WAGES

High. The Cost of Labor and the Labor-Cost, Elmer W. Leach. Am. Mach., vol. 53, no. 26, Dec. 2e, 1920, pp. 1188-1189. Suggests that wages be kept up by reducing labor cost, that is increasing production per man.

WATER HAMMER

Penstock. Water Hammer in Penstocks of High-Reaction Turbines (Sur le coup de bélier dans les conduites forcées alimentant des turbines à forte réaction), M. de Sparre. Comptes rendus des Séances de l'Académie des Sciences, vol. 171, no. 18, Nov. 2, 1920, pp. 833-835. Modifications to be made in general formula for maximum water hammer in a conduit to make it applicable to case of penstocks.

Pipe Lines. Water Hammer in Pipe Lines, W. F. Durand. Eng. News-Rec., vol. 85, no. 26, Dec. 23, 1920, pp. 1212-1216, 6 figs. Studies extended to include effects of imperfect reflection at discharge end, friction, non-uniform change of valve opening and imperfect action of discharge opening as nozzle.

WATER MAINS

Construction. Water and Gas Mains (Les conduites d'eau et de gaz). Nature (Paris), no. 2434, Nov. 27, 1920, pp. 338-343, 18 figs. Construction, maintenance and inspection.

WATER POWER

Developments in Canada. Power Development in Canada in 1920, Leo Denis. Can. Engr., vol. 39, no. 27, Dec. 30, 1920, pp. 649-650. Both public and private enterprise is active. Ontario hydro-electric power commission's Queenston work most important. Quebec strems commission assists development in Quebec. Keen interest in power from Atlantic to Pacific.

South Africa. Water-Power Schemes for the Union, F. E. Kanthack. So. African Jl. of Industries, vol. 3, no. 11, Nov. 1920, pp. 1043-1051. Discusses possibilities of 50 rivers.

Utilization of. The Technique of the Utilization of Water Power (Généralités sur la Houille blanche), G. Archer. Vie Technique & Industrielle, vol. 2, no. 14, Nov. 1920, pp. 113-117, 4 figs. Comparative economical study of coal and water power as sources of industrial energy. (To be continued)

WATER PURIFICATION

Methods. A Comparison of Various Methods of Water Purification, William Macklin Taylor. Chem. & Metallurgical Eng., vol. 24, no. 3, Jan. 19, 1921, pp. 123-129. Merits and disadvantages of methods of water-softening by filtration through zeolites, by chemical precipitation and by rectification with boiler compounds.

WATER SUPPLY

Metering. What is the Proper Size of Meter for Multiple-Family Houses, Jl. Am. Water Works Assn., vol. 8, no. 1, Jan. 1921, pp. 4-11, 1 fig. General discussion at Montreal convention.

WELDING

Autogenous. *See Autogenous Welding.*

Electric, Arc. *See Electric Welding, Arc.*
Oxy-Acetylene. *See Oxy-Acetylene Welding.*

WELDS

Testing. The Testing of Welds in Steel Plates, S. W. Miller. Ry. Elec. Engr., vol. 12, no. 1, Jan. 1921, pp. 49-52, 9 figs. Conditions which affect quality of welds; simple bend test and etching of sections recommended. Paper read before Chicago Section, Am. Welding Soc.

WIND TUNNELS

Gottingen. German Wind Tunnels and Apparatus, Edward P. Warner. Aeronautics, vol. 19, no. 376, Dec. 30, 1920, pp. 468-469, 2 figs. Description of Gottingen wind tunnels. (To be continued.)

Dust Collection. Efficient Dust-Collecting Systems. Wood-Worker, vol. 39, no. 10, Dec. 1920, pp. 30-32, 2 figs. Layout of dust collecting-systems in table factory.

WOMEN WORKERS

Adaptability. The New Place of Women in Industry—IV, Ida M. Tarbell. Indus. Management, vol. 61, no. 1, Jan. 1, 1921, pp. 51-58. Records of employment of women at International Harvester Co.

Telophone Industry. Women in Industry, Monthly Labor Rev., vol. 11, no. 6, Dec. 1920, pp. 117-125. Statistics of labor turnover and length of service in telephone industry in New York State.

WORKMEN'S COMPENSATION

Pennsylvania Law. Industrial Accidents and Their Cost, Walter F. Mulhall. Iron Age, vol. 106, no. 27, Dec. 30, 1920, pp. 1766-1767. Operation of Pennsylvania Compensation law.

Rates. A Plea for More Adequate Accident Compensation Rates, Ethelbert Stewart. Monthly Labor Rev., vol. 11, no. 6, Dec. 1920, pp. 1-10. Revision of State Compensation Laws.

Social Insurance and. Workmen's Compensation and Social Insurance, Carl Hookstadt. Monthly Labor Rev., vol. 11, no. 6, Dec. 1920, pp. 135-163, 1 fig. Comparison of compensation insurance systems as to cost, service, and security.

Engineering Index

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A

ABRASIVE WHEELS

Manufacture. Manufacturing Abrasive Wheels, Eng. Production, vol. 2, no. 16, Jan. 20, 1921, pp. 82-88, 14 figs. Methods of Universal Grinding Wheel Co., England.

ACCIDENTS

Dust Explosions. Some Electrical Causes of Dust Explosions, David J. Price. Elec. Rev. (Chicago), vol. 78, no. 5, Jan. 29, 1921, pp. 179-181, 5 figs. Results of investigations of explosions and fires attributed to electricity at Bur. of Chemistry, U. S. Dept. of Agriculture. Menace of static electricity to grain-threshing and cotton-mill operations.

AERONAUTICAL INSTRUMENTS

Uses. Aeronautic Instruments, Charles E. Mendenhall. Aerial Age, vol 12, no. 20, Jan. 24, 1921, pp. 512-515, 5 figs. Classification of instruments and methods of using.

AEROPLANE ENGINES

Superchargers. Turbine-Driven Aeroplane Engine Superchargers for Flight at High Altitudes (Les surpresseurs pour moteurs d'aéroplanes à commande par turbine, pour le vol aux hautes altitudes). Génie Civil, vol. 78, no. 3, Jan. 15, 1921, pp. 55-56, 2 figs. Economical advantages of supercharging engine at high altitudes. Supercharger constructed by Gen. Elec. Co.

AEROPLANES

Aerofoils. *See Wings.*

Design. Aeronautics in 1920—L. Engr., vol. 131, no. 3393, Jan. 7, 1921, pp. 5-7, 9 figs., partly on 2 supp. plates. Survey of developments in aeroplane design.

Aeroplane Design, F. S. Barnwell. Aeronautics, vol. 20, no. 379, Jan. 20, 1921, pp. 49-50. Table of airscrews of not more than 8 ft. diameter to absorb 1 hp. (Concluded.) Paper read before Cambridge University Aeronautical Soc.

Fuselage Construction. The Monocoque Fuselage, Lester D. Seymour. Aviation, vol. 10, no. 7, Feb. 14, 1921, pp. 203 and 206, 6 figs. Structural details of one-piece monocoque fuselage invented in France. Advantages of this type of construction.

Stabilizers. The Automatic Control of Aeroplanes. Engineering, vol. 111, no. 2876, Feb. 11, 1921, pp. 178-179, 3 figs. Aveline automatic control apparatus for aeroplanes.

Wings. A German Rival of the Handley-Page Wing Aviation, vol 10, no 6, Feb 7, 1921, p. 179, 1 fig Wing with peculiarly shaped passages which are said to increase both pressure on under side and suction on upper side. Translated from Flugsport.

The Action of Aeroplane Wings (Die Wirkungsweise der Tragflächen), H. Lorenz. Zeit. des Vereines deutscher Ingenieure, vol. 65, no. 1, Jan 1, 1921, pp. 8-11, 9 figs. Deals with pressure of wings, and the influence of inclination and camber surface.

The Glenn Martin High-Lift Wing. Aerial Age, vol. 12, no 23, Feb. 14, 1921, p. 585, 1 fig It is said that Glenn Martin Co. of Cleveland have designed aeroplane wing which can lift greater weight per sq. ft. than any other known type. No description of wing is given

The Internally Trussed Wing, William B. Stout. Aviation, vol. 10, no. 7, Feb. 14, 1921, p. 200. Comparative study of American and German designs

The Lachmann Aerofoil. Aerial Age, vol. 12, no. 22, Feb. 7, 1921, p. 560, 2 figs. German design consisting of several separate staggered elements arranged in form of Venetian blind. Translated from Flugsport

Torsion of Wing Trusses at Diving Speeds, Roy G. Miller. Nat. Advisory Committee for Aeronautics, report no. 104, 1920, 8 pp., 4 figs. Suggestions in regard to methods for analyzing stresses in wing truss in vertical dive at limiting velocity.

See also Seaplanes; Wind Tunnels.

AIRCRAFT CONSTRUCTION MATERIALS

Plywood. *See Plywood.*

Steels. British Standard Schedule of Cold Worked Steels for Aircraft. British Eng. Standards Assn., no. 112, Nov. 1920, 15 pp., 2 figs. Schedule of seven cold-worked steels in form of black bars Chemical composition, heat treatment and mechanical properties are specified.

British Standard Schedule of Sheet Steels for Aircraft. British Eng. Standards Assn., no. 113, Nov. 1920, 12 pp., 3 figs. Schedule of three sheet steels. Chemical composition, heat treatment and mechanical properties are specified.

British Standard Schedule of Valve and Valve Spring Steels for Aircraft. British Eng. Standards Assn, no. 114, Nov. 1920, 17 pp., 7 figs. Schedule of three valve steels and two valve-spring steels for aircraft engines Chemical composition, heat treatment and mechanical properties are specified for steel in form of bars, forgings and drop forgings.

British Standard Schedule of Wrought Steels for Aircraft. British Eng. Standards Assn., no. 111, Nov. 1920, 27 pp., 9 figs. Schedule of fourteen wrought steels in form of bars, billets, forgings and drop forgings. Chemical composition, heat treatment and mechanical properties are specified.

AIRSHIPS

Rigid. Speed Endurance of the Rigid Airship, E. H. Lewitt. Aeronautics, vol. 20, no. 379, Jan. 20, 1921, pp. 43-44, 2 figs. Graphs showing variation between speed, horsepower and capacity. (To be continued.)

Zeppelin. The Zeppelin Airships, L. 64 and L. 71, George Whale. Aeronautics, vol. 20, no. 377, Jan. 6, 1921, p. 9. Classification and description of types.

ALCOHOL

Peat as Source of. *See Peat, Gasoline from.*
See also Automobile Fuels, Alcohol.

ALLOY STEELS

Electrometric Analyses. The Electrometric Analyses of Special Steels (Analyses électrométriques des aciers spéciaux). Industrie Electrique, vol. 30, no. 686, Jan. 25, 1921, pp. 33-36, 5 figs. Industrial apparatus for determining chromium, vanadium, and manganese.

ALUMINUM

Castings. Analyze Loss in Aluminum Shops—IV, Robert J. Anderson. Foundry, vol. 49, no. 3, Feb. 1, 1921, pp. 104-111. Tables showing casting losses in various foundries on different castings. Percentages of losses from enumerated causes are indicated in case and comparisons are made.

Conductors. Standardization of Aluminum and Copper Bars for Switchboard Use (Unification des sections des barres de cuivre et d'aluminium pour tableaux de distribution). Revue générale de l'Electricité, vol. 9, no. 3, Jan. 15, 1921, p. 77. Established by Committee on Union of Electric Syndicates on Nov. 10, 1920.

Castings. Castings of Light Aluminum Alloys, Robert J. Anderson. Iron Age, vol. 107, no. 7, Feb. 1921, pp. 433-436, 15 figs. Value of microscopic examination in foundry practice. Its correlation with microstructure. Methods used and typical structures.

AMMONIA

Manufacture. Artificial Ammonia, Jacques Boyer. Sci. Am., vol. 124, no. 6, Feb. 5, 1921, pp. 110, 4 figs. Claude process in successful operation in France.

British Neutral Sulphate Process, E. V. Evans. Gas Age, vol. 47, no. 2, Jan. 25, 1921, pp. 44-46. Methods of neutralizing free acid by ammonia gas at South Metropolitan Gas Co., London. Paper read before Southern District Assn. of Gas Engrs. & Managers.

Saturated, Tables for. Temperature and Pressure Tables for Saturated Ammonia. Power, vol. 53, no. 3, Jan. 18, 1921, pp. 96-99. Tentative tables prepared by U. S. Bur. of Standards.

Synthetic. Manufacture of Synthetic Ammonia at Oppau, Germany—I. Chem. & Metallurgical Eng., vol. 24, no. 7, Feb. 16, 1921, pp. 305-308, 7 figs. Principle of process. Manufacture of producer gas and water gas used in process. Purification of gas mixture. Catalytic oxidation of carbon monoxide. Elimination of carbon dioxide and carbon monoxide. Translated from Technique Moderne.

AMMONIA ABSORPTION REFRIGERATING SYSTEM

Non-Condensible Gases in. Causes and Prevention of the Formation of Non-condensible Gases in Ammonia Absorption Refrigeration Machines, E. C. McKelvy and Aaron Isaacs Technologic Papers, Bur. of Standards, Dept. of Commerce, no. 180, Oct. 25, 1920, 10 pp., 1 fig. Method for quantitative estimation of carbon dioxide in ammonia is also given.

APPRENTICES, TRAINING OF

Draftsmen. How to Train Drafting Apprentices, S. E. Ferry. Indus. Management, vol. 61, no. 3, Feb. 1, 1921, pp. 95-97. Outline of two-year training course.

Methods. Programs of Apprenticeship and Special Training in Representative Corporations, J. V. L Morris. Am. Mach., vol. 54, no. 6, Feb. 10, 1921, pp. 230-232, 4 figs. Practice of Brown & Sharpe Mfg. Co., Providence, R. I. Apprentice training has gone on for 70 years. Present school holds classes during working hours. Co-operative students also are employed.

Programs of Apprenticeship and Special Training in Representative Corporations, J. V. L. Morris. Am. Mach., vol. 54, no. 8, Feb. 24, 1921, pp. 310-312, 3 figs. Practice of Bethlehem Shipbuilding Corp., Quincy, Mass. Sub-foremen are trained to act as instructors for new men.

School Education. Engineering Education, Charles C. Garrard. Eng. Rev., vol. 34, no. 7, Jan. 1921, pp. 175-178 and 180. Report of City of Birmingham Education Committee on school education of apprentices.

Textile Mills. Standardized Training of Textile Apprentices. Eugene Scepesi. Textile World, vol. 59, no. 6, Feb. 5, 1921, pp. 193 and 295, 298, 305 and 309, 10 figs. Uniform methods of industrial education, a means for reducing waste and loss accruing under present system.

AUTOMOBILE ENGINES

Air-Temperatuer Regulation. Air-Temperature Regulation Effects on Fuel Economy, Reuben E. Fielder. Jl. Soc. Automotive Engrs., vol. 8, no. 2, Feb. 1921, pp. 119-122, 7 figs. Tests conducted by Fifth Avenue Coach Co. of New York City to study temperature of air entering into cylinder.

Carburetors. *See Carburetors.*

Design. Fuel Problem in Relation to Engineering Viewpoint, A. L. Nelson. Jl. Soc. Automotive Engrs., vol. 8, no. 2, Feb. 1921, pp. 101-115, 33 figs. Account of extensive tests conducted with view of studying effect of engine design and correlation of results obtained for undertaking research of fuel problem.

Relation Between Principle Characteristics of an Automobile Engine (Relations entre les principales données constructives d'un moteur), Raymond Biscout. Technique automobile et aérienne, vol. 11, no. 111, 1920, p. 127, 1 fig. Graphs showing relation between cylinder diameter, piston stroke r.p.m. etc.

Eight-Cylinder, Balancing. Balancing of Eight-Cylinder Automobile Engine, and Order of Firing of Cylinders (Etude du moteur à huit cylindres en ligne au point de vue équilibrage et ordre du travail des cylindres). Technique automobile et aérienne, vol. 11, no. 111, 1920, pp. 97-125, 31 figs. Diagrams indicating stresses in crankshaft at various stages of rotation, computation of maxima stresses formulas for inertia forces, etc.

Engine Speed and Air Speed. Diagram Giving the Velocity of an Automobile in Terms of the R.P.M. of a Motor (Abaque donnant la vitesse d'une voiture en fonction de la vitesse de rotation du moteur), R. Bricout. Technique automobile et aérienne, vol. 11, no. 111, 1920, p. 126, 1 fig.

Hot-Spot Manifold. The Volatility of Internal-Combustion Engine Gasoline Frank A. Howard. Jl. Soc. Automotive Engrs., vol. 8, no. 2, Feb. 1921, pp. 145-148, 1 fig. Argument for further development, improvement and wider use of hot-spot manifold of automotive engines.

AUTOMOBILE FUELS

Alcohol. Researches on Alcohol as a Fuel for Internal Combustion Engines, Harold B. Dixon. Automotive Industries, vol. 44, no. 5, Feb. 3, 1921, pp. 211-215. Basic data on vapor pressure, ignition temperature, movement of flame through explosive mixtures and detonation of vapor of alcohol, gasoline, benzol and various mixtures of two of these fuels. Authorization of standard alcohol mixtures to be used with present engines is urged.

Naphthalene. The Combustion of Naphthalene Solutions in Internal Combustion Engines, L. S. Palmer. Automobile Engr., vol. 11, no. 146, Jan. 1921, pp. 31-34, 6 figs. Naphthalene dissolved in benzole to strength of 15 per cent by weight said to form efficient fuel for ordinary gasoline engines.

Research. Notes on Current Fuel Research, Jl. Soc. Automotive Engrs., vol. 8, no. 2, Feb. 1921, pp. 31-134. Answeres to circular letters sent to members of Soc. of Automotive Engrs., asking them method in which they were studying fuel problem and reasons for policy followed in their studies.

AUTOMOBILES

American-Made. 1921 Passenger Automobiles Listed with Their Technical Specifications. Motor Age, vol. 39, no. 4, Jan. 27, 1921, pp. 78-81. Tabulated data of American-made automobiles with makes of principal parts, including engine, lubrication and ignition systems, etc.

Battery Charging. Electric Vehicle Charging Equipments, E. Austin. Automobile Engr , vol. 11, no. 146, Jan. 1921, pp. 22-24, 6 figs. Machine built by Lancashire Dynamo & Motor Co. for working on polyphase circuit.

Body-Construction. Some Sheet Metal Body Work. Am. Mach., vol. 54, no. 8, Feb. 24, 1921, pp. 318-320, 6 figs. Operations involved in making metal bodies for Ford cars. Blanking, forming and finishing sheets.

Body Design. Style in Automobile Bodies, George J. Mercier. Jl. Soc. Automotive Engrs., vol. 8, no. 2, Feb. 1921, pp. 123-126, 1 fig. Prevailing body types and possible developments.

Brakes. Friction Metal for Brake Linings. Automotive Industries, vol. 44, no. 4, Jan. 27, 1921, p. 153, 1 fig. Adaptation of European practice facilitated by manufacture in this country of copper-lead alloy said to possess exceptional friction qualities. Tests with V-shape brake on truck promise well. Elimination of brake squeaking said to be effected. High friction coefficient claimed.

Brussels Show. The Brussels Stalon (Le salon de Bruxelles), H. Petit. Vie Automobile, vol. 16, no. 720, Dec. 25, 1920, pp. 476-481, 13 figs. Survey of exhibits. (To be continued.)

Chassis Design. Chassis Design for Fuel Economy, A. L. Putnam. Jl. Soc. Automotive Engrs., vol. 8, no. 2, Feb. 1921, pp. 167-168. Basis for research.

French. Automobile Production for 1921 (La production automobile pour 1921), Charle Faroux, Henri Petit and André Contet. Vie Automobile, vol. 16, no. 720, Dec. 25, 1920, pp. I-LXXIII, 120 figs. Particulars of types to be constructed during 1921 by leading French automobile works, including also projected designs of motorcycles and automobile accessories.

Transmission Gears. Impact Stresses in the Transmission Gears of Automobiles (Sur les chocs dans les engrenages de changement de vitesse des automobiles). A. Petot. Comptes rendus des Séances de l'Académie des Sciences, vol. 172, no. 1, Jan. 3, 1921, pp. 42-44. Formulas for computing stresses.

AUTOMOBILE INDUSTRY

Germany. The German Automobile and Aircraft Industries. Automobile Engr., vol. 11, no. 146, Jan. 1921, pp. 25-27. There have been no changes in principal designs. In contrast with England, France and Italy there is absence of Americanization in chassis design and construction.

AVIATION

Civil. Progress of British Civil Aviation. Aviation, vol. 10, no. 7, Feb. 14, 1921, pp. 207-208. Report of British Controller-General of Civil Aviation on progress of civil aviation covering six months period from April 1 to Sept. 30, 1920.

Commercial. The Design Requirements of Commercial Aviation, Grover C. Loening. Jl. Soc. Automotive Engrs., vol. 8, no. 2, Feb. 1921, pp. 135-144, 13 figs. Single-engined versus multi-engined planes. Desirable future developments.

Developments. Review of Aviation in 1920. Aviation, vol. 10, no. 3, Jan. 17, 1921, pp. 83-84. Prepared by Manufacturers' Aircraft Association.

Forest Fire Patrol. A Year of the Aerial Forest Fire Patrol. Flying, vol. 10, no. 1, Feb. 1921, pp 13-16. Report submitted by air officer of headquarters ninth corps area at San Francisco.

B

BALANCING MACHINES

Turbine-Rotor. Martin's Rotor Balancing Machine. Elec. Rev. (Lond.), vol. 83, no. 2253, Jan. 28, 1921, pp. 101-102, 4 figs. Patented machine for balancing rotors without rotation.

BATTERIES

Standard Cell. A New Form of Standard Cell. C. J. Rodman and T. Spooner. Elec. Jl., vol. 18, no. 2, Feb. 1921, pp. 65-69, 5 figs. Cadmium cell.

BEARING METALS

Anti-Friction. Anti-Friction Bearing Metals, P. W. Priestley. Metal Industry (N.Y.), vol. 19, no. 2, Feb. 1921, pp. 66-67. Chemical, physical, and thermal review.

White-Metal. High-Temperature Properties of White-Metal Bearing Alloys, John R. Freeman, Jr., and R. W. Woodward. Jl. Soc. Automotive Engrs., vol. 8, no. 2, Feb. 1921, pp. 149-154 and 162, 8 figs. Preparation of alloys, and table of properties.

BELTING

Leather, Effect of Humidity on. Effect of Relative Humidity on Leather Belts, F. W. Roys. Can. Machy., vol. 25, no. 5, Feb. 3, 1921, pp. 76-78 and 98, 9 figs. Explanation of humidity, relative humidity, testing apparatus, atmospheric control, standard conditions and series of tests. Paper read before Nat. Assn. Leather Belting Manufacturers.

Rubber. Rubber in Mine and Mill, A. M. Oliver. Eng. & Min. Jl., vol. 111, no. 6, Feb. 5, 1921, pp. 258-262, 3 figs. Formulas for computing sizes and plies of belting.

BLAST FURNACES

Combustion Regulation. Regulation of the Combustion in Cupola Furnaces and of Working Process through Measurement of the Blast Capacities (Die Kontrolle der Verbrennung im Kuppelofen und des Arbeitsvorganges durch Windmengenmessung), H. Bansen. Stahl u. Eisen, vol. 41, no. 4, Jan. 27, 1921, pp. 114-115, 2 figs. Gives chart showing comparison of the analysis of flue gas taken from cupola furnace with the combustion curve of coke, and defines measurement of nozzle resistance.

Developments in 1920. Blast Furnace Developments During 1920, Harvey W. Linhardt. Blast Furnace & Steel Plant, vol. 9, no. 1, Jan. 1921, pp. 20-22. Improvements in design, hot blast stoves, boiler plants, blowing engines, furnace appliances and gas cleaners.

Operation. Study of Coke Hardness, Owen R. Rice. Iron Trade Rev., vol. 68, no. 6, Feb. 10, 1921, pp. 423-426, 4 figs. Tests made in three stacks of Bethlehem Steel Co. to determine relation of furnace condition to coke hardness. (Abstract.) Paper read before Am. Inst. Min. & Metallurgical Engrs.

BLOWERS

Power Chart. Notes on the Calculation of Blower Systems, John L. Alden. Power, vol. 53, no. 5, Feb. 1, 1921, pp. 180-183, 2 figs. Power chart for air blowers, and friction chart for air piping.

BOILER FEEDWATER

Treatment. Saving Money by Water Treatment, Paul M. LaBach. Ry. Maintenance Engr., vol. 17, no. 1, Jan. 1921, pp. 17-20, 3 figs. Water treating plants installed by Rock Island system, and results obtained.

BOILER OPERATION

Coal Saving. Coal-Saving in the Chemical Industry, David Brownlie. Pamphlet published by Brownlie & Green, England, 15 pp. Rules for scientific control of steam boiler plant based on records of performance of 60 typical steam boiler plants of chemical industry of Great Britain. Reprinted from Chem. Trade Jl. & Chem. Engr., Aug.-Sept. 1920.

Feedwater Regulation. Scientific Boiler Feed Water Regulation, Roland Moeller. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 27, no. 1, Jan. 1921, pp. 19-24, 6 figs. Automatic mechanical device.

Firing. Influence Upon Boiler Economy of Continuous Firing of Highly Volatile Fuel Without Intervening Cleaning, A. B. Reck. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 27, no. 1, Jan. 1921, pp. 1-5, 3 figs. Results of two tests with bituminous coal one made before and another after fourteen days of continuous firing with same fuel without intervening cleaning.

BOILERS

Inspection. A National System for the Inspection and Registration of Steam Boilers. Power, vol. 53, no. 2, Jan. 11, 1921, pp. 58-61. Plea for adoption by all States of Boiler Code of Am. Soc. Mech. Engrs., which was formulated by committee composed of representatives of users, designers and manufacturers of boilers and boiler materials after numerous and exhaustive hearings in which representatives of every interest affected took part. This Boiler Code has been adopted as standard by Boiler Inspection Departments of 17 states.

BOILERS, WATER-TUBE

Mercantile Marine. Advantages of the Use of the Water-Tube Boiler in the Mercantile Marine, James Kemnal. North-East Coast Instn. of Engrs. & Shipbuilders, Advance paper, 9 pp., 8 figs. Advantages of water-tube boiler over cylindrical type.

BORING MACHINES

Horizontal. Recent Machine Tool Developments. Engineering, vol. 111, no. 2873, Jan. 21, 1921, pp. 66-69, 25 figs. partly on supp. plate. Horizontal boring machines.

BRAKES

Shoe Design. Designing Brake Heads for Uniform Shoe Wear, H. M. P. Murphy. Ry. Mech. Engr., vol. 95, no. 2, Feb. 1921, pp. 107-108, 5 figs. Principle applicable to heads used on wheels revolving in one or both directions.

BRASS

Nickel. Nickel Brasses. Chem. & Metallurgical Eng., vol. 24, no. 6, Feb. 9, 1921, pp. 261-265, 6 figs. Summary of work of Leon Guillet published in "Revue de Métallurgie" of 1913 and 1920 on important role played by nickel in manufacture of low-copper ternary brasses.

Ternary. Ternary Brasses. Chem. & Metallurgical Eng., vol. 24, no. 4, Jan. 26, 1921, pp. 177-178, 1 fig. Mathematical study of equilibrium diagrams, and results of studies made by various investigators, notably L. Guillet in Revue de Métallurgie.

BRICK

Concrete. Concrete Bricks Made Without Forms on Commercial Basis. Eng. News-Rec., vol. 86, no. 4, Jan. 27, 1921, pp. 148-151, 6 figs. Horizontal knife cuts from concrete column slice which vertical knives divide into standard size. 100,000 bricks per day plant capacity.

BRIDGE FOUNDATIONS

Design and Construction. Design and Construction of Bridge Foundations, Llewellyn N. Edwards. Can. Engr., vol. 40, no. 7, Feb. 17, 1921, pp. 227-232, 5 figs. Conditions affecting stream scour. Adequate foundation surveys important. Characterictics of foundation materials, including bedrock, gravels, sands, clays, soft soils and earth. Artificial foundations, including compacted soils, grillage, piles and cribs.

BRIDGES, CONCRETE

Long-Span. Long-Span Reinforced Concrete Bridges (Les ponts en arc à grande portée en beton armé). Génie Civil, vol. 77, no. 26, Dec. 25, 1920, pp. 530-533, 10 figs. Reinforced-concrete structures of more than 300 ft. in span, built in Germany, Sweden and Italy.

Reconstruction. The Reconstruction of Warrington Bridge. Engineering, vol. 111, no. 2876, Feb. 11, 1921, pp. 158-160, and 172, 10 figs. Bridge has clear span of 134 ft. and is 80 ft. wide.

BRIDGES, RAILWAY

Reconstruction. Allegheny River Bridge Reconstructed at New Grade. Eng. News-Rec., vol. 86, no. 7, Feb. 17, 1921, pp. 284-287, 5 figs. Baltimore & Ohio R.R. crossing at Pittsburgh replaced by new structure of longer spans at higher elevation. New side span raised 15 ft. when channel span, built at new grade, is rolled in.

BROACHES

Manufacture. The Design and Manufacture of Broaches. Eng. Production, vol. 2, no. 17, Jan. 27, 1921, pp. 122-126, 3 figs. With special reference to parts having internal splines.

BUILDING CONSTRUCTION

Rammed Earth. Use of Rammed Earth as "Masonry" in Building Construction, Thomas Crane Young. Eng. News-Rec., vol. 86, no. 6, Feb. 10, 1921, pp. 267-268, 3 figs. Test for compression showed strength of 125 lbs. per sq. in.

Standard Practices. Report of Standard Practices Committee. Can. Engr., vol. 40, no. 4, Jan. 27, 1921, p. 165. Suggestions and broad general lines for adoption and amplification by various associations that are collective members of Assn. Can. Building & Construction Industries.

BUILDINGS

Air Infiltration. A Study of the Infiltration of Air in Buildings, O. W. Armspach. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 27, no. 1, Jan. 1921, pp. 43-53, 3 figs. Progress report upon tests that are being carried out jointly by Research Bureau and U. S. Bureau of Mines.

Steel-Frame. *See Electric Welding, Steel-Frame Buildings.*

BUSES

Trolley-Operated. The Trackless Trolley Abroad, James W. Welsh. Aera, vol. 9, no. 7, Feb. 1921, pp. 720-729, 13 figs. Data on operation in England, Germany, Austria and China. Advantages claimed for trolley operated bus are low initial investment and cheap operating and maintenance costs.

C

CABLES, ELECTRIC

Insulation. Higher Temperatures in Cable Insulation. Elec. World, vol. 77, no. 8, Feb. 19, 1921, pp. 413-415, 2 figs. Low-tension cables were subjected to intermittent tests at excessive loads with little damage to insulation. Higher temperature limits are recommended based upon load factor.

Paper-Insulated. Notes on the Effect of Heat on Impregnated Paper from Cable Insulation, Wallace S. Clark. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 2, Feb. 1921, pp. 113-114. Tests made to determine temperature at which marked deterioration in impregnated paper took place.

Permissible Operating Temperatures of Impregnated Paper Insulation in which the Dielectric Stress is Low, L. L. Elden. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 2, Feb. 1921, pp. 145-148. Edison Elec. Illuminating Co. of Boston records of loads of 230-volt d.-c. feeders from 1910 to 1920. In 18 years of use of single-conductor and concentric low-tension feeder cables there is no record of failure of these cables due to loading conditions.

The Maximum Safe Operating Temperature of Low-Voltage Paper-Insulated Cables, W. A. Del Mar. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 2, Feb. 1921, pp. 131-134, 7 figs. Experiments showed that continuous operation at 100 deg. cent. for less than a month seriously impairs mechanical condition of impregnated paper.

Stranded. Measurement of Relative Eddy Current Losses in Stranded Cables, James A. Cook. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 2, Feb. 1921, pp. 93-95, 5 figs. Experimental measurements of eddy-current losses in cables of various strands.

CAR AXLES

Design. Notes on Axle Design. Machy (Lond.), vol. 17, no. 434, Jan. 20, 1921, pp. 494-495, 3 figs. Chart for determining centrifugal force exerted on car axles when turning a curve.

CAR WHEELS

Chilled-Iron. Chilled-Iron Car-Wheels — Their Manufacture, Properties and Uses (Les roues en fonte trempée, leur fabrication, propriétés et usages), M. E. Polushkin. Revue de Métallurgie, vol. 17, no. 11, Nov. 1920, pp. 713-735, 20 figs. European and American practices contrasted. (To be continued.)

CASE HARDENING

Bibliography. Review of Case Carbonizing, 1920, O. A. Knight. Forging & Heat Treating, vol. 7, no. 1, Jan. 1921, pp. 51-54 and 65. Review and synopsis of important articles relative to case carbonizing which have appeared in current technical journals past during year.

Nitrogen and. Nitrogen and Case-Hardening, Henry Fay. Chem. & Metallurgical Eng., vol. 24, no. 7, Feb. 16, 1921, pp. 289-290. Nitrogenizing process which takes place when steel is heated in cyanide.

Steel. A New Method of Case Hardening Steel, William J. Merten. Trans. Am. Soc. for Steel Treating, vol. 1, no. 4, Jan. 1921, pp. 270-273, 1 fig. Heated Steel is brought into contact with pure nascent gas continuously generated in separate unit, preferably under pressure.

CAST IRON

Briquetting Refuse. The "Boreas" Cast-Iron Refuse Briquetting Machine. Foundry Trade Jl., vol. 23, no. 229, Jan. 6, 1921, p. 20, 1 fig. Manufactured by Colley Engineering & Machinery Co., London, England.

CEMENT

Bauxite. Cast Cements and the Electric Furnace, M. J. Bied. Practical Engr., vol. 63, no. 1767, Jan. 6, 1921, pp. 6-7, 2 figs. Strength of bauxite cement. Translated from Revue de l'Ingénieur et Index Technique.

CEMENT, PORTLAND

"Marque Speciale." "Marque Spéciale" Swiss Cement. Cement & Eng. News, vol. 33, no. 2, Feb. 1921, pp. 30-32. Portland cement with properties for developing early strength.

CENTRAL STATIONS

Operation. Operation of Electric Central Stations (Étude des conditions de fonctionnement des centrales électriques)G. Jochmans. Société Belge des électriciens, vol. 34, Nov.-Dec. 1920, pp. 261-273, 6 figs. Construction of load diagram. (To be continued.)

CHAINS

Testing. Chains and Lifting Gear. Mech. World, vol. 69, no. 1776, Jan. 14, 1921, pp. 36-37. Proving and testing. (Abstract.) Home Office pamphlet, of H. M. Stationery Office, Imperial House, London.

CHIMNEYS

Construction. Ordinance for Construction of Chimneys Proposed by the Nation-Board of Fire Underwriters. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 27, no. 1, Jan. 1921, pp. 25-28.

Design. Chimneys — Practical Features of Design, Terrell Croft. Power, vol. 53, no. 7, Feb. 15, 1921, pp. 257-260, 15 figs. Causes tending to destroy chimneys. Effects of wind pressure. Location of center of wind pressure. Sustaining ability of soil. Graphic method of determining tasbility of chimneys.

CHUCKS

Magnetic. Magnetic Chucks. Ellsworth Sheldon. Am. Mach., vol. 54, nos. 4 and 5, Jan. 27 and Feb. 3, 1921, pp. 121-124 and 7 figs., 177-180, 8 figs. Principle of operation and structural details of various types; classification of magnetic chucks.

Magnetic Chucks—II. Am. Mach., vol. 54, nos. 6, 7 and 8, Feb. 10, 17 and 24, 1921, pp. 213-217, 8 figs., 265-269, 14 figs., and 324-329, 12 figs. Feb. 10: History of developments. First magnetic chuck patent issued 48 years ago. Early chucks and their construction. Progress from 1873 to 1914. Feb. 17: Characteristics of various types. Feb. 24: Downes, Patton and Walker types.

CIRCUIT BREAKERS

Blow-Out Forces. The Measurement of the Magnetic Blow-Out Forces in Circuit Breakers, A. C. Bartlett. Elecn., vol. 86, no. 2225, Jan. 7, 1921, p. 48, 4 figs. Measurements at Research Laboratories of General Electric Co., London.

Oil. High-Current Tests on High-Tension Switchgear, Philip Torchio. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 2, Feb. 1921, pp. 120-131, 24 figs. Tests on oil circuit breakers and disconnecting switches to determine their strength at brush contacts and supports in withstanding mechanical stresses engendered by magnetic flux due to flow of large currents of order of 100,000 amperes, as may exist at times of short-circuits on large systems.

Selecting Oil Circuit Breakers, H. L. Wallau. Elec. World, vol. 77, no. 5, Jan. 29, 1921, pp. 252-253, 2 figs. Graph showing rupturing strength of circuit breakers under various voltages.

CITY PLANNING

Saskatchewan. Town Planning and Development in Saskatchewan, W. A. Begg. Can. Engr., vol. 40, no. 7, Feb. 17, 1921, pp. 219-222, 4 figs. Resume of developments since passing of town planning and rural development act, and of methods of regulating land subdivision employed since 1909.

Zoning. Zoning and City Planning, Thomas Adams. Can. Engr., vol. 40, no. 4, Jan. 27, 1921, pp. 167-168. Comparison of progress in United States and Canada. (Concluded.)

CLUTCHES

Ring. The Design of Expanding Ring Clutches, W. A. Milnes. Mech. World, vol. 69, no. 1776, Jan. 14, 1921, pp. 25-26, 4 figs. Computation of dimensions.

COAL

Briquetting. Anthracite Conservation by Briquetting, A. L. Stillman. Coal Industry, vol. 4, no. 2, Feb. 1921, pp. 100-103, 4 figs. Description of briquetting plant.

Distillation. By-Products of Coal Distillation (L'extraction des différents produits de la distillation de la houille), A. Grebel. Génie Civil, vol. 78, no. 2, Jan. 8, 1921, pp. 35-37, 2 figs. Processes and installation of Commentry-Fourchambault et Decazeville Society.

Recovery from Ashes. Fuel Recovery from Ashes. Eng. Production, vol. 2, no. 16, Jan. 20, 1921, p. 99, 1 fig. Typical plant in operation in French works for recovery from ashes unburnt coal in form of coke breeze.

COAL HANDLING

Scraper Loading. Costs of Scraper Loading and Conditions Under Which It Works Best, A. B. Benedict. Coal Age, vol. 19, no. 5, Feb. 3, 1921, pp. 222-226, 4 figs. Where coal is clean, faces fairly long, top good and above all where cars can be supplied regularly and in adequate number, scraper loader has successfully met widely varying conditions.

COAL MINES

Bituminous, Fire Prevention in. Causes and Prevention of Fires and Explosions in Bituminous Coal Mines, Edward Steidle. Dept. of Interior, Bur. of Mines, Miners' Circular 27, 1920, 75 pp., 117 figs. List of common causes of fires and explosions, prepared from examination of report of State Mine Dept. and of Bur. of Mines.

Electricity in. State Mining Laws on the Use of Electricity in and about Coal Mines, L. C. Ilsley. Dept. of Interior, Bur. of Mines, technical paper 271, 1920, 53 pp., 1 fig. 28 states have regulations prepared by commissions or enacted laws governing operation of coal mines.

COAL TAR

Research. Coal-Tar Research at Shadyside, John Morris Weiss and Charles Raymond Downs. Chem. & Metallurgical Eng., vol. 24, no. 4, Jan. 26, 1921, pp. 150-155, 6 figs. Account of expansion of scope and facilities of research department of Barrett Co. Study of physical properties, methods of testing and development of synthetic products.

COAL WASHING

Experimental Station. Coal Washing at the Northwest Experimental Station, Earl R. McMillan. Elec. Rev. (Chicago), vol. 78, no. 4, Jan. 22, 1921, pp. 142-145, 2 figs. Bur. of Mines plant prepared to recover 150,000 tons of culm in one dump.

COKE

Hardness Testing. Importance of Hardness of Blast Furnace Coke, Owen R. Rice. Iron Age, vol. 107, no. 6, Feb. 10, 1921, pp. 380-381, 1 fig. Apparatus used at Bethlehem Steel Co. to determine hardness of coke. (Abstract.) Paper read before Am. Inst. Min. & Metallurgical Engrs.

COAL MANUFACTURE

Demster-Toogood Retorts. Demster-Toogood Continuous Verticals at Hawick. Gas World, vol. 74, no. 1905, Jan. 22, 1921, pp. 64-66, 2 figs. Demster-Toogood patented coking retort.

COKE-OVEN GAS

Composition. Composition of Coke-Oven Gases (Sur la composition de quelques gaz de fours à coke), P. Lebeau and A. Damienn. Comptes rendus des séances de l'académie des Sciences, vol. 171, no. 26, Dec. 27, 1920, pp. 1385-1386. Records of examinations.

COKE OVENS

By-Product. By-Product Coke Oven Plants of Yesterday and Today, J. M. Hastings, Jr. Blast Furnace & Steel Plant, vol. 9, no. 1, Jan. 1921, pp. 10-13, 6 figs. Progress of art in 28 years as illustrated by old and new plants of Semet-Solvay Co. Despite improvements original characteristics still remain.

The By-Product Coke Oven Industry, 1920, C. J. Ramsburg. Blast Furnace & Steel Plant, vol. 9, no. 1, Jan. 1921, p. 18. First large battery of triangular-flue-type ovens completed and successfully operated during year. Special construction features installations of year.

COMPRESSED AIR

Metering. The Metering of Compressed Air, John L. Hodgson. Colliery Guardian, vol. 121, no. 3135, Jan. 28, 1921, pp. 271-272, 10 figs. Types of meters in use. Paper read before Midland Inst. Min., Civil & Mech. Engrs.

CONCRETE

Specifications. Some Controversal Points in Concrete Specifications, Frank Barber. Jl. Eng. Inst. of Canada, vol. 4, no. 2, Feb. 1921, pp. 117-122. Discussion on difficulties in preparing concrete specifications, with particular reference to provision of greater detail in clauses dealing with workmanship.

Strength. How Quantity of Mixing Water Affects Strength of Concrete. Eng. World, vol. 18, no. 2, Feb. 1921, p. 95, 1 fig. Diagram constructed from tests made at Structural Material Research Laboratory, Lewis Inst., Chicago. Rule derived is to use smallest quantity of mixing water that will produce workable mix.

Tannic Acid, Effect on. Effect of Tannic Acid on the Strength of Concrete, Duff A. Abrams. Structural Matls. Research Laboratory, Lewis Inst., bul. 7, Nov. 1920, 31 pp., 16 figs. Tests conducted under auspices of Am. Soc. for Testing Matls. Strength of concrete was reduced for all percentages of tannic acid, for all mixes, and ages used. Less than 0.1 per cent of tannic acid in terms of weight of aggregate may reduce strength of concrete to one-half its normal value. Reprinted from Proc. Am. Soc. for Testing Matls.

CONCRETE CONSTRUCTION

Costs. On the Economics of Building Design, J. Morrow Oxley. Jl. Eng. Inst. of Canada, vol. 4, no. 2, Feb. 1921, pp. 123-130, 8 figs. Graphs and tables showing relative effect on cost of variations in proportions, dimensions and floor loading for standard types of buildings

Hessian System. The Hessian Fabric System of Concrete Construction. Concrete & Constructional Eng., vol. 16, no. 1, Jan. 1921, pp. 62-64, 3 figs. Walls are erected in situ by means of wooden molds which are raised course by course until wall is completed.

Stresses. Latest Developments in Concrete, H. C. Boyden. Nebraska Blue-Print, vol. 19, no. 4, May 1920, pp. 72-85. Survey of researches on stresses of concrete structures, and of laws which have been formulated for designing them.

CONCRETE REINFORCED

Bond in. Bond in Reinforced Concrete. Engr., vol. 131, no. 3395, Jan. 21, 1921, pp. 65-66. Results of tests in which bars were pushed through in prisms of concrete. Comparison with tests in which bars were pulled out.

Slabs. The Strength of Reinforced-Concrete Slabs with Cross-Reinforcement (Krydsarmerede Jærnbetonpladers Styrke), N. J. Nielsen. Ingeniören, vol. 29, no. 94, Nov. 24, 1920, pp. 723-728, 8 figs. It is shown that the ultimate stresses in reinforced concrete can be calculated by means of differential equations. Numerical examples for square and rectangular plates.

Stress Formula. Formula for Computing Compressive Stress that can be Borne by Reinforced Concrete (Formule rationnelle du taux de compression du béton), M. Mougnié. Annales des Ponts et Chaussées, vol. 5, no. 10, Sept.-Oct. 1920, pp. 142-154. Formula involving coefficient which is ratio of theoretical moduli of elasticity of steel and concrete.

Testing Reinforcing Steel. Tests on High Tension Steels in Reinforced Concrete Design, H. Kempton Dyson. Surveyor, vol. 59, no. 1514, Jan. 21, 1921, pp. 39-40. Experiments by sub-committee of Concrete Inst.

CONTRACTORS

Code of Ethics. Proposed Code of Ethics for Contractors. Eng. News-Rec., vol. 86, no. 6, Feb. 10, 1921, pp. 257-258. Submitted at New Orleans convention for consideration of the members of Associated General Contractors.

CONTRACTS

Cost-Plus and Lump-Sum. General Conditions of Contract. Contract Rec., vol. 35, no. 4, Jan. 26, 1921, pp. 93-97. Clauses for incorporation in both cost-plus and lump-sum contracts to define clearly obligations of all parties to agreement. Discussed at Construction Conference of Association of Canadian Building & Construction Industries.

Standard Forms. Standard Contract Forms. Contract Rec., vol. 35, no. 5, Feb. 2, 1921, pp. 114-115. Final forms of agreement as adopted at Winnipeg Conference of Assn. of Can. Building & Construction Industries.

CORE OVENS

Electric. Electric Heating in the Iron Industry, Wirt S. Scott. Iron Age, vol. 107, no. 6, Feb. 10, 1921, pp. 384-385. Development of electric core ovens for foundry and experiences with heat treating furnaces.

COST ACCOUNTING

Power Plants. Armour System of Power Plant Accounting, H. O. A. Ar[illegible] Power, vol. 53, no. [illegible], Feb. 1, 1921, pp. 170-174, 11 figs. Report system supplemented by charts and table to eliminate calculations.

CRANKSHAFTS

Crankpin Turning Machine. Rotating-Tool Crank Pin Turning Machine. Engr., vol. 131, no. 3396, Jan. 28, 1921, pp. 102-103, 3 figs. Machine belongs to class in which crankshaft is held stationary while tools for turning up pins and inside surfaces of webs are carried in revolving slide. Manufactured by George Richards & Co., England.

D

DIE CASTINGS

Uses. Application of Inserts to Die Castings, M. Stern. Am. Mach., vol. 54, no. 7, Feb. 17, 1921, pp. 284-286, 9 figs. Division of application of inserts into four general groups. Various methods of providing inserts with anchors. Locating points.

DIES

Manufacture. A School for Die Sinkers, J. H. G. Williams. Forging & Heat Treating, vol. 7, no. 1, Jan. 1921, pp. 36-38. Manner in which die-sinkers' school is conducted by Billings & Spencer Co., Hartford, Conn.

Composition and Hardening of Die Blocks, James H. Herron and A. L. Wurster. Forging & Heat Treating, vol. 7, no. 1, Jan. 1921, pp. 34-36. Physical properties conferred by composition. Tempers at which die blocks are furnished.

The Design and Construction of Press Tools—I. Eng. Production, vol. 2, no. 18, Feb. 3, 1921, pp. 148-149, 4 figs. Table of allowances for punch and die for different thicknesses and materials.

DIESEL ENGINES

Armstrong-Sulzer. The Armstrong-Sulzer Marine Diesel Engine. Steamship, vol. 32, no. 379, Jan. 1921, pp. 179-182, 5 figs. Manufactured by Sir W. G. Armstrong, Whitworth & Co., England.

Marine. Marine Diesel Engine of 5,400 Shaft Horse-Power. Motorship, vol. 6, no. 2, Feb. 1921, p. 121, 2 figs. Sulzer two-cycle motor for propulsion of ocean liners.

Nordberg. Nordberg 2000 B. H. P. Two-Cycle Diesel Engine. Motorship, vol. 6, no. 2, Feb. 1921, pp. 114-118, 5 figs. Carels type four-cylinder engine with 500 b.hp. cylinder output.

DRAINAGE

Perforated-Pipe Filter. An Investigation of Perforated-Pipe Filter Under-drains, Harry N. Jenks. Eng. News-Rec., vol. 86, no. 4, Jan. 27, 1921, pp. 162-166, 5 figs. Limits determined of head required to obtain uniformity of discharge along laterals, of size and spacing of laterals and perforations.

DREDGES

Pump Efficiency. Effect of Worn Runners on Dredge Pump Efficiency, Ivan E. Houk. Eng. News-Rec., vol. 86, no. 4, Jan. 27, 1921, pp. 169-170, 1 fig. Comparative tests of new and worn runners show economic necessity of providing for prompt replacement.

DRILLING

Square Holes. Square Hole Drilling Attachment. Engineering, vol. 111, no. 2872, Jan. 14, 1921, pp. 43-44 and 46, 9 figs. Radbore head for drilling square holes from solid exactly as ordinary drilling machine drills round holes only difference in operation being that feed is put on traversing work instead of traversing drill.

DRILLING MACHINES

Pneumatic Clamps. Pneumatically Operated Clamps for Drilling Machines, J. V. Hunter. Am. Mach., vol. 54, no. 5, Feb. 3, 1921, pp. 180-181, 4 figs. Devices developed in locomotive shops of Wabash Railroad Co., Decatur, Ill.

Vertical. A new Vertical Drilling Machine. Eng. Production, vol. 2, no. 16, Jan. 20, 1921, p. 103, 2 figs. Machine is designed for high-speed twist drills and is capable of drilling holes up to 2½ in. diameter in steel. It is manufactured by Fairbairns & Co., Leeds, England.

DROP FORGING

Industry. The Drop Forging Industry in 1920-1921, L. W. Alwyn Schmidt. Forging & Heat Treating, vol. 7, no. 1, Jan. 1921, pp. 4-7. Past year was one of general readjustment. Change in business psychology recommended. Effect of readjustment of prices on level of production still in excess of prewar volume.

DYNAMOMETERS

Heenan-Froude. The Heenan-Froude Dynamometer. Flight, vol. 13, no. 4, Jan. 27, 1921, p. 65, 2 figs. Dynamometer for testing internal-combustion engines.

E

EFFICIENCY, INDUSTRIAL

Olympia Exhibition. The "Efficiency" Exhibition at Olympia. Engineering, vol. 111, no. 2876, Feb. 11, 1921, pp. 176. Machine and methods designed to bring about personal and civic efficiency and efficiency of transport of production and of use of fuel. (To be continued.)

ELECTRIC CIRCUITS, A. C.

Short-Circuits. Short-Circuits in Alternating Current Networks and Means of Protecting Against Them (Sur les accidents de mise à la masse dans les réseaux à courant alternatif et les moyens de protection), J. Perret. Revue générale de l'Électricité, vol. 9, no. 4, Jan. 22, 1921, pp. 107-109, 4 figs. Method of protection by employing single-phase self reactance at origin of feeder.

ELECTRIC DRIVE

Industrial Applications. The Electric Drive in Industry. Beama, vol. 8, no. 1, Jan. 1921, pp. 45-54, 15 figs. Applications of electric drive to printing presses, and machine tools.

ELECTRIC FURNACES

Fuel-Fired Furnaces vs. Relative Thermal Economy of Electric and Fuel-Fired Furnaces, E. F. Collins. Trans. Am. Soc. for Steel Treating, vol. 1, no. 4, Jan. 1921, pp. 217-227 and (discussion) pp. 227-229, 5 figs. Graphs showing relative efficiency at various temperatures, also relative cost of fuel and fuel heat losses.

Induction. High-Frequency Induction Steel-Furnace, E. F. Northrup. Chem. & Metallurgical Eng., vol. 24, no. 7, Feb. 16, 1921, pp. 309-311, 3 figs. Combination of crucible-melting flexibility with advanced practice of electric melting, manufactured by Ajax Electrothermic Corp.

Iron Foundries. Electric Furnaces in the Iron Foundry, Richard Moldenke. Iron Age, vol. 107, no. 7, Feb. 17, 1921, pp. 437-439. Cost and advantages of duplexing or electric melting of cold scrap. Control of sulphur, manganese and phosphorus. Paper read before Am. Inst. Min. & Metallurgical Engrs.

Non-Ferrous Metals. Electric Furnaces for Non-Ferrous Metals, John B. C. Kershaw. Engr., vol. 131, no. 3394, Jan. 14, 1921, pp. 44 and 48-50, 7 figs. Results of tests made under three different systems of operation with two furnaces, one of ordinary brass-melting type, provided with lift-out crucible, and other of tilting type. Systems of operation were (1) continuous operation for 24 hours a day, (2) 10-hr. operation, and (3) special 10-hr. operation, in which sufficient power was maintained during night to keep furnace hot.

Oil, Gas and Coal Furnaces vs. Relative Economy of Oil, Gas, Coal and Electric Heated Furnaces, Seth A. Moulton and W. H. Lyman. Trans. Am. Soc. for Steel Treating, vol. 1, no. 4, Jan. 1921, pp. 249-270. Comparative operating costs, comparative annual production, and comparative advantages and disadvantages.

Operation. Operating Details of Electric Furnaces, Edward T. Moore. Chem. & Metallurgical Eng., vol. 24, no. 4, Jan. 26, 1921, pp. 171-176, 7 figs. Excerpt from report of electric furnace committee of Association of Iron & Steel Electrical Engineers based on questionnaire submitted to steel manufacturers operating electric furnaces.

Smelting. Electric Smelting Furnaces—I, F. Rowlinson. Beama, vol. 8, no. 1, Jan. 1921, pp. 14-22, 8 figs. Survey of developments in utilization of electric furnace for steel making.

Steel Manufacture. English and American Types of Electric Iron and Steel Furnaces Compared, John B. C. Kershaw. Foundry Trade Jl., vol. 23, nos. 229, 230 and 231, Jan. 6, 13 and 21, 1921, pp. 5-7, 2 figs., 29-30, 2 figs., and 53-55, 3 figs. Heroult, Ludlum and Rennerfelt types.

The Electric Furnace, E. T. Moore. Assn. Iron & Steel Elec. Engrs., vol. 3, no. 1, Jan. 1921, pp. 5-8. Recent applications, specially in steel manufacture.

See also Steel Castings, Electric Melting.

ELECTRIC GENERATORS, A. C.

Waterwheel-Driven. Measurement of Load on Large Water-Wheel Driven Alternators, C. W. Leonard. Power, vol. 53, no. 4, Jan. 25, 1921, pp. 136-138, 2 figs. Results of tests on 5000 kw. unit.

ELECTRIC LOCOMOTIVES

Comparison of Types. Economic and Constructive Aspects in the Construction of Modern Large Electric Locomotives (Wirtschaftliche u. konstruktive Gesichtspunkte im Bau neuerer Gross-Elektrolokomotiven), Alb. Laternser. Schweizerische Bauzeitung, vol. 77, no. 5, Jan. 29, 1921, pp. 49-51, 6 figs. Description of the 1C+C1 type of the Swiss Federal Railway for high-voltage single-phase current, 15,000 volt, 16⅔ periods, and the 2 C 2 type Gr. E 332 of the Italian State Railroad for 3-phase current 3000 volt, 16⅔ periods, both constructed by the Oerlikon Machine Factory; and a comparison of them with recent American types of the Gen. Elec. and Westinghouse Cos.

Design. The Application of the Electric Locomotive to Main-Line Traction on Railways, H. E. O'Brien. Jl. Instn. Elec. Engrs., vol. 28, no. 295, Sept. 1920, pp. 858-869, 9 figs. Elements of design are developed from examination of performance data of C. M. & St. P. Railway and on Italian and Swiss railways.

Freight. Freight Electric Locomotives of the Swiss Federal Railways, Constructed by Oerlikon Works (Locomotives électriques à marchandises des chemins de fer fédéraux suisses construites par les ateliers d'Oerlikon). Génie Civil, vol. 78, no. 2003, Jan. 1, 1921, pp. 1-3, 2 figs. Type, 2-6-6-2; tension, 15,000 volts; maximum grade, 2.6 per cent; horsepower, 1700.

Operation. Train Handling with Electric Locomotives, W. S. H. Hamilton. Ry. Age, vol. 70, no. 3, Jan. 21, 1921, pp. 227-231, 5 figs. Records of operation in electrified section of C. M. & St. P. Railway.

ELECTRIC MOTORS

Installation. Electrical Features of Motor Installations, Gordon Fox. Power Plant Eng., vol. 25, no. 3, Feb. 1, 1921, pp. 168-172, 7 figs. Tables giving d.c. motor currents and volts for cables necessary for continuous rated motors, wire capacity of conduits, wire sizes for a.c. motors, etc.

Temperature Rise. Allowable Temperature Rise for Motors, H. M. Phillips. Power, vol. 53, no. 2, Jan. 11, 1921, pp. 62-65, 2 figs. Comparisons between fifty-degree and forty-degree rise motors. Standardization rules of A.I.E.E. and Electric Power Club on temperature rise. Two armatures having same temperature at full load may have different temperatures at increased load. Tables making comparisons of insulations when subjected to various temperatures.

ELECTRIC RAILWAYS

Freight-Train Service. Electric Motive Power in Freight Train Service, W. S. H. Hamilton. Ry. Age, vol. 70, no. 5, Feb. 4, 1921, pp. 323-326, 3 figs. One C. M. & St. P. Locomotive handles 2800-ton trains on 0.7 to 1 per cent ascending grades. Speed-tractive effort curves on resistance for Chicago. Milwaukee & St. Paul freight locomotives.

Maintenance. Maintenance on the B., A. & P., F. W. Bellinger. Elec. Ry. Jl., vol. 57, no. 5, Jan. 29, 1921, pp. 217-219, 10 figs. Seven years of operation of Butte, Anaconda & Pacific under strenuous conditions have demonstrated staying qualities of electric locomotive. Maintenance costs with this type of motive have been substantially less than with steam engine. Shop force of about thirty men suffices for inspection and repair work.

Track Construction. Track Construction in Poughkeepsie, A. J. Stratton. Elec. Ry. Jl., vol. 57, no. 8, Feb. 19, 1921, pp. 344-347, 14 figs. Built with 103-lb. grooved girder rail with bolted and seam welded joints, steel ties and foundation and paving of concrete.

ELECTRIC SWITCHES

Oil. Effective Oil-Switch Overhauling, F. I. Morgan. Elec. World, vol. 77, no. 4, Jan. 22, 1921, pp. 193-196, 4 figs. Methods used in caring for typical switch in large Pennsylvania power plant to insure maximum operating efficiency.

ELECTRIC TRANSMISSION LINES

Economical Construction. Building Transmission Lines Vs. Paying Freight on Coal. H. L. Wallau. Elec. World, vol. 77, no. 8, Feb. 19, 1921, pp. 422-423, 1 fig. Determining factors are fixed charges of line, freight charges on fuel and relative thermal efficiencies and construction costs of two plants.

High-Tension. A New Record in High Tension Transmission, John A. Koontz. Jl. Electricity, vol. 46, no. 2, Jan. 15, 1921, pp. 58-59, 4 figs. Line carrying electricity at 165,000 volts is made of steel-core aluminum conductors having 37-strand cable consisting of 7 strands of steel and 30 of aluminum.

Locating Resistance Faults. A Loop Test for High Resistance Faults, H. V. Higgitt. Elecn., vol. 86, no. 2227, Jan. 21, 1921, pp. 96-97, 1 fig. Modified method of taking Jamieson loop test.

ELECTRIC WELDING

Seam-Welding, Machines. Electric Seam-Welding Machines, Alfred Gradenwitz. Am. Mach., vol. 54, no. 4, Jan. 27, 1921, pp. 128-129, 5 figs. Intermittent process designed by German firm.

Steel-Frame Buildings. Electrically Welded Steel Frame Building. Engineering, vol. 111, no. 2872, Jan. 14, 1921, pp. 55-56, 8 figs. Details of buildings constructed by welding methods in England.

EMPLOYMENT MANAGEMENT

Des Moines Employment Association. Consolidate Employment Study, H. C. Pfund. Iron Trade Rev., vol. 68, no. 4, Jan. 27, 1921, pp. 286-289 and 293, 6 figs. Association formed by employers in Des Moines, Iowa, "to promote harmony and co-operation between employer and employee," and to "encourage continuous employment."

Duties of Manager. The Employment Manager in an Engineering Works. Engineering, vol. 111, no. 2873, Jan. 1921, pp. 65-66. Duties of manager. Technique of hiring men.

Railways. The Functions of a Railway Employment Service, J. C. Clark. Ry. Age, vol. 70, no. 5, Feb. 4, 1921, pp. 329-331. Methods of selecting best men and following up new employees.

Selecting Employees. Simple Tests for Selecting Office Workers, Eugene J. Benge. Indus. Management, vol. 61, no. 3, Feb. 1, 1921, pp. 91-93, 3 figs. Suggests method of devising and standardizing clerical tests.

Sizing Up the Qualities of a Man, Walter D. Scott. Can. Manufacturer, vol. 41, no. 2, Feb. 1921, pp. 39-41, 1 fig. Suggested classification of personnel qualifications. Position for which man of known character is best suited.

ENAMELS

Iron and Steel. A Reading List on Vitreous Enameling on Iron and Steel, Clarence Jay West. Jl. Am. Ceramic Soc., vol. 4, no. 1, Jan. 1921, pp. 47-64. Bibliography for years 1907 to 1920.

ENGINEERS

Training of. Some Suggestions for the Training of Engineers, Annson S. J. Hall. Trans. Inst. Mar. Engrs., vol. 32, Dec. 1920, pp. 251-267 and (discussion) pp. 267-277. Combination of technical training and industrial apprenticeship.

EXCAVATION, EARTH

Building Foundations. A Concrete Job Mechanical. Public Works, vol. 50, no. 2, Jan. 8, 1921, pp. 26-29, 4 figs. Excavation work for foundations of new municipal building in New York City. (Concluded.)

EXECUTIVES

Duties of. How to Develop Executive Ability Through Personality, G. Sumner Small. Indus. Management, vol. 61, no. 3, Feb. 1, 1921, pp. 115-118. Study of principle underlying good organization. Means whereby executive can definitely, systematically and surely build morale in his subordinates.

F

FACTORY MANAGEMENT

See Industrial Management.

FATIGUE

Industrial. Fatigue in Steel Works. Iron & Coal Trades Rev., vol. 102, no. 2758, Jan. 7, 1921, pp. 6-9. Report of Industrial Fatigue Research Board, England.

Industrial Fatigue, Charles S. Myers. Jl. Royal Soc. of Arts, vol. 69, no. 3558, Jan. 28, 1921, pp. 150-156 and (discussion) pp. 156-159. Method of measuring fatigue.

Output in Boot and Shoe Factories. Eng. & Indus. Management, vol. 5, no. 3, Jan. 20, 1921, pp. 70-72, 9 figs. Investigations carried out by Industrial Fatigue Research Board.

FERROMANGANESE

Electric-Furnace Production. The Electric Furnace for Production of Ferromanganese, E. S. Bardwell. Jl. Electricity & Western Industry, vol. 46, no. 3, Feb. 1, 1921, pp. 120-122. Method of Anaconda Copper Mining Co.

FILTERS, SAND

Operation. Results of 15 Years' Operation of the Indianapolis Filters. Eng. News-Rec., vol. 86, no. 5, Feb. 3, 1921, pp. 218-219. Operation of slow-sand filters has proven successful.

Slow vs. Drifting Installation. Toronto Filtration Plant, James Milne. Contract Rec., vol. 35, no. 6, Feb. 9, 1921, pp. 139-143. Slow- and drifting-sand installations compared.

FIREBRICK

Spalling. A Study of Spalling, Raymond M. Howe and Robert F. Ferguson. Jl. Am. Ceramic Soc., vol. 4, no. 1, Jan. 1921, pp. 32-46, 11 figs. Comparison of laboratory spalling tests of firebricks and behavior in service.

FLOOD CONTROL

California. Control of Flood and Tidal Flow in the Sacramento and San Joaquin Rivers, California, C. S. Jarvis. Proc. Am. Soc. Civil Engrs., vol. 47, no. 1, Jan. 1921, p. 3. Review of progress made toward flood control on Sacramento and San Joaquin Rivers, and description of new conditions obtaining along lower courses of these rivers which seem to demand exclusion of tidal effects from these channels. (Abstract.)

FORGING

Drop Hammers. Application of Compressed Air to Drop Hammers and Forging Presses. Forging & Heat Treating, vol. 7, no. 1, Jan. 1921, p. 27. Details of work done at U. S. Navy Yard, Norfolk, Va.

Forge Shops. Forge Plant for 75 MM Projectiles, T. W. Towler. Blast Furnace & Steel Plant, vol. 9, no. 2, Feb. 1921, pp. 168-171, 5 figs. Shop designed to turn out from 50,000 to 55,000 shell forgings daily.

FORGINGS

Sand-Blasting. Sand-Blasting Forgings and Sand-Blasting Versus Pickling, H. D. Gates. Forging & Heat Treating, vol. 7, no. 1, Jan. 1921, pp. 72-74, 4 figs. Comparison of costs.

FOUNDATIONS

Concrete. Methods and Plant for Constructing Concrete Substructure of New York County Court House. Eng. & Contracting, vol. 55, no. 4, Jan. 26, 1921, pp. 75-78, 5 figs. Construction of foundation rings sub-basement floor and exterior walls extending up to street grade.

See also Bridge Foundations, Design.

FUELS

Oil. *See Oil Fuel.*

Turf. A New Process of Drying Turf for Fuel in Finland. Chem. & Metallurgical Eng., vol. 24, no. 5, Feb. 2, 1921, p. 215. Raw turf in swamp is freed from all old roots and changed to thin mud, by powerful jet of water under pressure of 20 atmospheres. Mud is pumped out on drying field and spread in layers from 20 to 30 cm. in depth which are subsequently cut into bricks

Utilization. The Work of the Committee for the Utilization of Fuels (Travaux de la commission d'utilisation des combustibles), Cornu-Thénard. Revue de Métallurgie, vol. 17, no. 11, Nov. 1920, pp. 757-764. Committee was appointed by French Ministry of Public Works. First report of Committee deals with results obtained in steel works with mixture of coal and wood in Martin furnace.

See also Coal; Lignite, Oil Fuel; Pulverized Coal.

FURNACES, ANNEALING

Continuous. Tunnel Furnace for Continuous Annealing. Iron & Coal Trades Rev., vol. 102, no. 2759, Jan. 14, 1921, p. 49, 2 figs. Advantages claimed for tunnel type of furnace is that by gradual advance of cold material into annealing zone all calorific value of waste gases can be usefully absorbed, leaving only sufficient temperature in outlet to create necessary draft in chimney stack.

FURNACES, BOILER

Lignite-Burning. The Adaptation of Steam-Boiler Furnaces to Lignite Coals (Die Umstellung der Dampfkesselfeuerungen auf Rohbraunkohle), H. Pradel. Braunkohle, vol. 19, nos. 38, 39 and 40, Jan. 1, 8 and 15, 1921, pp. 469-472, 477-482 and 489-492, 7 figs. Impressions from the Furnace Engrs.' Convention in Berlin, Germany. Concludes with summary of author's recommendations.

Turbine. The Turbine Patent Furnace. Elec. Times, vol. 59, no. 1525, Jan. 6, 1921, p. 11, 2 figs. Designed on principle of impulse turbine. Air through corresponds to nozzle and fire-bars to blades of turbine.

FURNACES, ELECTRIC

See Electric Furnaces.

FURNACES, HEAT-TREATING

Electric. Recent Developments in Electric Heat-Treating Furnaces, H. O. Swoboda. Forging & Heat Treating, vol. 7, no. 1, Jan. 1921, pp. 83-85. Applications to date. Classification of electric heating furnaces as to resistor construction, resistor material, charging and operating and control. Discussion of cost of operation.

FURNACES, REVERBERATORY

Charging Method. New Method of Charging Reverberatory Furnaces, J. O. Ambler. Eng. & Min. Jl., vol. 111, no. 5, Jan. 29, 1921, p. 226, 1 fig. Experimental machine designed for charging material at practically continuous rate into furnace by mechanical means, without production of dust.

G

GAGES

Developments. Recent Developments in Gauging Apparatus. Eng. Production, vol. 2, no. 15, Jan. 13, 1921, pp. 40-44, 12 figs. Machines recently introduced by Alfred Herbert, Coventry, England, notably gear pitch and concentricity measuring machine and universal gage measuring machine.

Dial. Gauging with Dial Instruments. Engr., vol. 131, no. 3395, Jan. 21, 1921, pp. 76-77, 4 figs. Dial gages for gaging thickness, length, diameters, depth, etc.

GAGING

Limit. Limit Gauging. Jl. Instn. Mech. Engrs., no. 9, Jan. 1921, pp. 1089-1124, 25 figs. partly on 5 supp. plates. Technical considerations on formation of system of limits. Description of gage testing apparatus designed and used at National Physical Laboratory, England.

GAS ENGINES

Steel Works. The Gas Engine in Iron and Steel Works, T. B. Morley. Elecn., vol. 86, no. 2227, Jan. 21, 1921, pp. 99-102, 9 figs. Galloway tandem-cylinder engines.

Testing. The Working and Testing of a Gas Engine, Arthur G. Robson. Practical Engr., vol. 63, no. 1768, Jan. 13, 1921, pp. 20-23, 18 figs. Methods of testing.

GAS MANUFACTURE

Standards. Standards for Gas Service. Dept. of Commerce, Circular of Bur of Standards, no. 32, 140 pp., Dec. 7, 1920. Recommended standards in regard to manufacture of coal gas, carbonated water gas, by-product oven gas, oil gas and mixture of these.

GAS TURBINES

Elements. The Gas Turbine, B. Pochobradsky. Beama, vol. 8, no. 1, Jan. 1921, pp. 9-13. Gas turbines are classified into explosion and constant-pressure turbines. Technical elements of each of these types are studied.

GAS WORKS

Developments. Gas works Engineering in 1920. Engr., vol. 131, no. 3393, Jan. 7, 1921, p. 12. Survey of developments.

GASOLINE

Natural Gas. Gasoline by the Charcoal Absorption Process, G. A. Burrell, G. G. Oberfell and C. L. Voress. Chem. & Metallurgical Eng., vol. 24, no. 4, Jan. 26, 1921, pp. 156-160, 7 figs. Description of activated charcoal process for absorbing vapors from natural gas. Comparison with commercial processes; activated coconut shell charcoal; absorption and selection; steam distillation of saturated carbon; yields and quality of products.

Gasoline from Natural Gas. V—Hydrometer for Small Amounts of Gasoline, R. P. Anderson and C. E. Hinckley. Jl. Indus. & Eng. Chem., vol. 13, no. 2, Feb. 1921, pp. 144-145, 3 figs. Apparatus for rapid and fairly accurate determination of gravity of gasoline when quantity is insufficient to float usual type of hydrometer.

Peat as Source of. *See Peat, Gasoline from.*

GEAR CUTTING

Hobbing Machines. Automatic Hobbing Machine. Iron Age, vol. 107, no. 4, Jan. 27, 1921, pp. 259-260, 3 figs. Machine designed for rapid production of helical and herringbone gears.

Newark No. 5 Automatic Gear-Hobbing Machine. Am. Mach., vol. 54, no. 4, Jan. 27, 1921, pp. 157-158, 1 fig. Machine designed for rapid production of helical gears.

GEARS

Grinding. The Precision Grinding of Hardened Gears. Eng. Production, vol. 2, no. 18, Feb. 3, 1921, pp. 158-161, 8 figs. Machine for grinding gears developed by Sulzer Bros., England.

Helical. *See Gear Cutting, Hobbing Machines.*

Worm. Worm Gear Design, S. Bramley-Moore. Machy. (Lond.), vol. 17, no. 434, Jan. 20, 1921, pp. 474-480, 20 figs. Study of forces acting, formulas for computing dimensions, and comparison of types of worm gears. Paper read before Instn. Automobile Engrs.

GRINDING

Centreless. Centreless Grinding. Eng. & Indus. Management, vol. 5, no. 2, Jan. 13, 1921, pp. 39-41, 3 figs. Machines which have been developed for grinding straight cylindrical work without centres.

Cylindrical, Speeds for. Work Speeds in Cylindrical Grinding. Machy. (Lond.), vol. 17, no. 434, Jan. 20, 1921, pp. 481-483. Importance of using proper speed. Fallacy of idea that the faster the rotation of work, the higher rate of production.

GRINDING MACHINES

Surface. Rotary Surface Grinding Machine. Engineering, vol. 111, no. 2874, Jan. 28, 1921, pp. 100-102, 13 figs. Constructed by Heald Machine Co., Worcester, Mass. Machine is designed for flat grinding of small articles such as can be held by magnetic chuck.

GUN METAL

Tests on. Gun-Metal, J. Arnott. Foundry Trade Jl., vol. 23, no. 229, Jan. 6, 1921, pp. 2-4, 11 figs. Suggests restriction of term "gun-metal" to ternary alloy copper-tin-zinc. Tests on metal of composition 87 per cent copper, 9 per cent tin, 3 per cent zinc and one per cent lead. Paper read before Scottish Branch Instn., British Foundrymen.

H

HACK-SAWING MACHINES

English. A New Hack Sawing Machine. Machy. (Lond.), vol. 17, no. 435, Jan. 27, 1921, p. 524, 2 figs. Designed to cut bars up to 6 in. diameter. Manufactured by Blundstone Engineering Service, Coventry, England.

HANDLING MATERIALS

Electric Power in. Application of Electrical Power to Modern Handling Plants, H. C. Widlake. Chem. Age (Lond.), vol. 4, no. 82, Jan. 8, 1921, pp. 38-40, 5 figs. Survey of developments.

Economies in Handling Materials in Industrial Plants, J. S. Tuthill. Elec. World, vol. 77, no. 4, Jan. 22, 1921, pp. 201-202. Instances of savings effected by electrically operated material handling machinery and examples of adaptation to cover varying needs.

Inter-Floor Transportation. Inter-Floor Transportation by the d'Humy Motoramp System, Harold F. Blanchard. Eng. World, vol. 18, no. 2, Feb. 1921, pp. 105-106, 2 figs. Staggered floor construction.

HEAT TRANSMISSION

Pipe Coverings. Emissivity of Heat from Various Surfaces, V. S. Day. Power House, vol. 14, no. 2, Jan. 20, 1921, pp. 17-23, 11 figs. Tests carried out at experiment station of University of Illinois. Heat loss was greater through asbestos paper-covered pipes than through same pipes uncovered.

HEATING, ELECTRIC

Industrial. Unusual Industrial Heating Developments, Wirt S. Scott. Elec. World, vol. 77, no. 6, Feb. 5, 1921, pp. 307-310, 6 figs. Developments of electric air heating for textile mills. Typical uses to which electric heat can be applied.

HOUSES, CONCRETE

England. Concrete Cottage Building. Housing at Liverpool. Concrete & Constructional Eng., vol. 16, no. 1, Jan. 1921, pp. 22-29, 9 figs. Heavy concrete walling patented by Economic Building Corporation.

Ingersoll System. Concrete House Construction at Valley View Development of Ingersoll-Rand Co. Eng. & Contracting, vol. 55, no. 4, Jan. 26, 1921, pp. 89-90, 4 figs. Monolithic structures of rapid construction.

Concrete-Block. Rebuilding the City of Halifax, A. J. R. Curtis. Building Age, vol. 43, no. 2, Feb. 1921, pp. 21-23, 8 figs. Concrete-block houses with monolithic foundations.

HOUSING

Financing, England. How Great Britain is Financing Half a Million Homes, R. J. Caldwell. Indus. Management, vol. 61, no. 3, Feb. 1, 1921, pp. 106-107, 1 fig. Description of London housing bond plan.

HYDRAULIC TURBINES

Design. Tendencies in Development of Hydraulic Prime Movers, S. L. Shuffleton. Jl. Electricity & Western Industry, vol. 46, no. 3, Feb. 1, 1921, pp. 116-118, 3 figs. Capability of handling increasingly higher heads and involving increasingly large concentration of power in single units.

Installations. New Western Turbine Installations, Lewis F. Moody. Jl. Electricity & Western Industry, vol. 46, no. 3, Feb. 1, 1921, pp. 119-120, 1 fig. Survey of turbine installations now under construction by I. P. Morris Dept. of William Cramp & Sons Ship & Engine Building Co., Philadelphia.

Lubrication. Lubrication of Hydraulic Turbines. Lubrication, vol. 6, no. 11, Dec. 1920, pp. 1-8, 9 figs. Scheme for lubrication of large turbines of Niagara Falls Power Co.

Niagara Falls Power Development. The Hydraulic Turbines for Niagara Falls. Power House, vol. 14, no. 2, Jan. 20, 1921, pp. 24-26, 6 figs. Each of these machines will develop 61,000 b.hp. at 187½ r.p.m. They will be coupled to 45,000-kva. vertical generators. Turbine casing weighs 110 tons.

Theory. Contribution to the Theory of High-Speed Hydraulic Turbines (Contributo alla teoria delle turbine idrauliche veloci), Giacomo Buchi. Industria, vol. 34, no. 23, Dec. 15, 1920, pp. 561-567, 17 figs. Comparative examination of design features of leading types, together with records of experiments. (To be continued.)

Wellman-Seaver-Morgan. Hydraulic Turbines for Queenston Development. Can. Engr., vol. 40, no. 5, Feb. 3, 1921, pp. 185-186A, 6 figs. Casings, runners and speed rings of two Wellman-Seaver-Morgan units of 61,000 hp. capacity each.

HYDROELECTRIC PLANTS

France. The Great Modern Hydroelectric Plants (Les grandes distributions électriques modernes), A. Troller. Nature (Paris), no. 2433, Nov. 20, 1920, pp. 326-332, 7 figs. Tendencies in design and construction as shown in latest installations, notably hydroelectric plant at Eget in the Pyrénées.

Simplon Tunnel. The Termination of the Simplon Tunnel (L'achèvement du tunnel du Simplon), J. Boudet. Vie technique & industrielle, vol. 2, no. 16, Jan. 1921, pp. 305-314, 30 figs. Hydroelectric installation at north entrance. (Continuation of serial.)

Surge Tanks. Diaphragm Increases Surge Tank Capacity. Can. Engr., vol. 40, no. 3, Jan. 20, 1921, p. 145, 2 figs. Added penstock threatened to overtop tank, but surge is throttled down by plate with small opening.

Water Control. Water Control on Hydro-Electric Systems, R. C. Denny. Power, vol. 53, no. 6, Feb. 8, 1921, pp. 208-212, 10 figs. Operating procedure for hydroelectric system of six plants utilizing combined static head of 2637 ft. Description of storage reservoirs and methods of conveying water to plants. Measurement of evaporation from reservoirs. Evaporation from one reservoir has been as high as 30 acre-feet per day.

Water Supply, Forecasting. Snow Surveying for the Forecasting of Stream Flow, J. E. Church, Jr. Eng. News-Rec., vol. 86, no. 6, Feb. 10, 1921, pp. 244-218, 2 figs. Methods, factors and results in making spring predictions of summer water supply for irrigation and power in streams fed by mountain snows.

I

IMPACT

Duration of. Research on Duration of Impact (Recherches sur la durée du choc), George Moreau. Annales de Physique, vol. 14, Nov.-Dec. 1920, pp. 306-333, 2 figs. Measurements of duration of impact between ball and plain by electrical process, and empirical formula for calculating it.

INDUSTRIAL MANAGEMENT

Budget Control System. A Budget Control System which is Producing Results, Norman G. Shidle. Automotive Industries, vol. 44, no. 6, Feb. 10, 1921, pp. 269-271, 8 figs. System of management which enables distributors and managers to know which departments are making money and which are not making money. System developed at Packard-Chicago distributors.

Expense Reduction. How to Reduce Expenses without Hurting the Business. Factory, vol. 26, no. 2, Jan. 15, 1921, pp. 167-170 and 198, 2 figs. Suggestions from executives in representative industrial works.

Inspection. The Part Inspection Plays in Good Management, Howell B. May. Factory, vol. 26, nos. 2 and 3, Jan. 15 and Feb. 1, 1921, pp. 175-179, 5 figs., and 335-339, 4 figs. Organization and operation of inspection department and selection of necessary personnel.

Instruction Sheets. Proposals for New Factory Instruction Sheets (Entwürfe neuer Betriebsblätter). Betrieb, vol. 3, no. 6, Dec. 25, 1920, pp. 44-45. Proposal of the Committee for Economic Production for instruction sheet for the use of tapers.

Proposals for New Factory Instruction Sheets (Entwürfe neuer Betriebsblätter). Betrieb, vol. 3, no. 7, Jan. 10, 1921, pp. 50-51. Proposal of the Committee for Economic Production for an instruction sheet for the fabrication and use of screw dies.

Overhead Expense. Distributing Overhead Expense by the Machine Hour Rate Method, Christopher Haigh. Automotive Industries, vol. 44, no. 4, Jan. 27, 1921, pp. 172-177. Advantages of machine hour rate method over four other methods—man rate, man hour, sold hour, and material and labor. Paper read before Am. Gear Manufacturers' Assn.

Planning. The possibilities of Planning, E. A. Pells. Eng. & Indus. Management, vol. 5, no. 3, Jan. 20, 1921, p. 69. Functions of planning office and its place in management administration.

Production Systems. Less Wages, or More Work?, Maxwell Droke. Indus. Management, vol. 61, no. 3, Feb. 1, 1921, pp. 103-105. Writer holds that 20 per cent increase in production is safer and saner than 20 per cent decrease in wages.

Modern Production Methods—XIV, W. R. Basset. Am. Mach., vol. 54, no. 5, Feb. 3, 1921, pp. 187-191, 8 figs. Method of analyzing labor costs and their relation to final cost of manufactured article.

Routing. Handling and Routing Large Work. Machy. (Lond.), vol. 17, no. 435, Jan. 27, 1921, pp. 501-507, 17 figs. Methods for routing of work through factory.

Routing Considered as a Function of Up-To-Date Management—IV, H. K. Hathaway. Indus. Management, vol. 61, no. 3, Feb. 1, 1921, pp. 126-134, 8 figs. Evolution of progress sheet into assembling route sheet.

Safety Departments. What is the Business of a Safety Department? Henry Landesman. Am. Mach., vol. 54, no. 7, Feb. 17, 1921, pp. 260-264. Significance of safety department in industrial plants. Advantages of safety departments.

Statistics, Compiling of. Making Statistics Talk—III, M. C. Rorty. Indus. Management, vol. 61, no. 3, Feb. 1, 1921, pp. 119-125, 9 figs. Mathematical and semi-mathematical uses of graphics.

Stock Records. Accurate Methods in Keeping Stock Records, Fred J. Huntley. Automotive Industries, vol. 44, no. 3, Jan. 20, 1921, pp. 125-128, 6 figs. System at plant of Cadillac Motor Car Co., Detroit.

See also Efficiency, Industrial.

INDUSTRIAL RELATIONS

Arbitrating Disputes. When You Arbitrate, Chesla C. Sherlock. Am. Mach., vol. 54, no. 4, Jan. 27, 1921, pp. 130-132. Three kinds of arbitration recognized by law.

Collective Bargaining. Tyrannous Labor Leaders, Parlor Socialists and So-Called Collective Bargaining, Henry Herbert Squire. Indus. Management, vol. 61, no. 3, Feb. 1, 1921, pp. 138-140. Protest against "tyranny of labor leaders."

Incentive Plans. How Rewards Help Workers at Their Jobs. Iron Age, vol. 107, no. 5, Feb. 3, 1921, pp. 317-320. Report of Committee on Labor Relations of Cleveland Chamber of Commerce.

Open Shop. Open Shop Wins at Golden Gate, Don Partridge. Iron Trade Rev., vol. 68, no. 6, Feb. 10, 1921, pp. 418-422, 5 figs. Works council system reported to be working satisfactorily in shipyards, commercial shops and manufacturing plants of San Francisco Bay District.

The Philosophy of the Closed Shop in Action, James A. Emery. Open Shop Rev., vol. 18, no. 1, Jan. 1921, pp. 3-24. Arguments in favor of adopting open-shop principle in U. S. Address delivered before Nat. Founders Assn.

Strikes. *See Strikes.*

INDUSTRIAL TRUCKS

Railways. Electric Vehicles for Railway Purposes—II. Ry. Gaz., vol. 34, no. 3, Jan. 21, 1921, pp. 67-69, 6 figs. Device adopted by British railway companies.

INSULATION

Paper. Permissible Operating Temperatures of Impregnated Paper Insulation in Which Dielectric Stress is Low, Philip Torchio. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 2, Feb. 1921, pp. 96-104, 24 figs. Effect of temperature on insulating materials as reported in 1913 Steinmetz and Lamme report, and 1905 British Eng. Standards Committee tests. Surveys of low tension cables in large distributing systems, and tests on cables including sheath cracking, high temperature tests, effect of bending on cables heated at high temperatures, distillation of cable compounds, ambient temperatures in subway ducts as affected by thermal conductivity of concrete, amount of moisture in soil, different arrangements of ducts and load factors at which cables are operated. From this review conclusion is derived that permissible operating temperatures are to be a function of load factors at which cables operate. Temperatures of 105, 95 and 90 deg. cent. are recommended for load factors of 33, 50 and 60 per cent, respectively.

INSULATORS, HEAT

Magnesia. Characteristics of 85 per cent Magnesia as a Non-Heat-Conducting Covering, Edward R. Wiedlein. Heat & Vent. Mag., vol. 18, no. 2, Feb. 1921, pp. 30-34, 11 figs. Results of tests, with curves showing most economical thickness of pipe covering for different conditions.

Conservation of Heat in Power and Heating Systems, Edward R. Weidlein. Chem. & Metallurgical Eng., vol. 24, no. 7, Feb. 16, 1921, pp. 295-300, 10 figs. Discussion of 85 per cent magnesia insulation, showing low depreciation rate under wetting and drying and high-temperature conditions. Chart for determining economical amount of insulation. Amounts of coal, heat and money saved by insulation. Paper read before Am. Inst. Chem. Engrs.

INTERCHANGEABLE MANUFACTURE

Machined Fits. An Analysis of Machined Fits. Mech. Eng., vol. 43, no. 2, Feb. 1921, pp. 132-133 and 144, 12 figs. Questionnaire being sent to manufacturers by Subcommittee on Standards and Tolerances for Manufactured Material, and sectional committee on Plain Limit Gages for General Engineering Work, a sectional committee which is working under Rules of Procedure of Am. Eng., Standards Committee and is sponsored by Am. Soc. Mech. Engrs.

Fatigue of. Criterion for Determining Fatigue of Internal-Combustion Engines (Au sujet de la détermination d'un critère de fatigue générale des moteurs à combustion interne), M. Dumanois. Comptes rendus des Séances de l'Académie des Sciences, vol. 172, no. 1, Jan. 3, 1921, pp. 44-46. Coefficient of general fatigue is expressed in terms of variations of temperature of inside wall of cylinder.

Fuels for. Oils for Internal Combustion Engines, J. L. Chaloner. Trans. Inst. Mar. Engrs., vol. 32, Dec. 1920, pp. 215-232, 8 figs. Comparative study of suitability of fuels used.

Testing of Oils for Internal Combustion Engines, Tom McKenzie. Trans. Inst. Mar. Engrs., vol. 32, Dec. 1920, pp. 232-247 and (discussion) pp. 247-250, 6 figs. Tests required in specifications of internal-combustion engine fuels.

(*See also Diesel Engines; Dynamometers; Gas Engines; Gas Turbines; Motorcycles, Engine for; Oil Engines; Tractor Engines.*)

L

IRRIGATION

Forecasting of Stream Flow. Snow Surveying for the Forecasting of Stream Flow, J. E. Church, Jr.—II. Eng. News-Rec., vol. 86, no. 7, Feb. 17, 1921, pp. 300-304. Methods, factors and results in making spring predictions of summer water supply for irrigation and power in streams fed by mountain snows.

LABOR

Three-Shift vs. Two-Shift System. The Three-Shift System in the Steel Industry, Horace B. Drury. Bul. Taylor Soc., vol. 6, no. 1, Feb. 1921, pp. 2-49. Survey of conditions in some 20 American steel mills where change from two-shift to three-shift has been introduced, with notes on introduction of three-shift system almost exclusively in European and English steel works. Paper read at point meeting of Taylor Soc., Metropolitan and Management Section of Am. Soc. of Mech. Engrs. and New York Section, Am. Inst. Elec. Engrs.

LATHES

Automatic. The Hartness Automatic Lathe. Am. Mach., vol. 54, no. 7, Feb. 17, 1921, pp. 273-275, 7 figs. Machine intended for large production. Head placed at angle. Groups of tools carried by two bars. All movements controlled by single camdrum.

Turret. Turret Lathe Applications, J. H. Moore. Can. Machy., vol. 25, no. 6, Feb. 10, 1921, pp. 38-41, 15 figs. Tooling necessary for machining engine cylinder, clutch cone, clutch cone gear, and peculiar-shaped tractor driving-axle arm.

LIGHTING

Factory. Present Day Illumination Standards, George C. Cousins. Jl. Eng. Inst. of Canada, vol. 4, no. 2, Feb. 1921, pp. 105-109, 7 figs. Relations between good lighting and increased efficiency, with tables showing results of better lighting in factory.

LIGNITE

Combustion. Combustion of Lignites and High-Moisture Fuels, T. A. Marsh. Combustion, vol. 4, no. 2, Feb. 1921, pp. 39-44, 7 figs. Methods of burning these fuels and results in their combustion. Paper read before Stoker Manufacturers' Assn.

LOCOMOTIVES

Design. Locomotives and Rolling Stock of 1920, Eng., vol. 131, no. 3393, Jan. 7, 1921, pp. 10-12 and 14, 6 figs. Survey of developments in design.

Electric. *See Electric Locomotives.*

Feedwater Treatment. Railway Water Treatment Pays Large Returns. Paul M. LaBach. Ry. Age, vol. 70, no. 3, Jan. 21, 1921, pp. 247-248, 2 figs. Results obtained by Rock Island system.

Manufacture. Methods in a Locomotive Works. Eng. Production, vol. 2, no. 15, Jan. 13, 1921, pp. 55-64, 34 figs. Practice of Midland Railway Co., England.

Oil-Burning. Experience of a French Railway with Oil Burning Locomotives (Note sur les premiers essais à la compagnie d'Orléans du chauffage des foyers de locomotives au "fuel oil"), Louia Bigourat. Revue générale des Chemins de Fer, vol. 40, no. 1, Jan. 1921, pp. 9-32, 10 figs. Apparatus employed and results obtained. Comparison with coal-burning locomotives.

Reconstruction. Practical Reconstruction of Old Locomotives, Ry. Age, vol. 70, no. 3, Jan. 21, 1921, pp. 237-240, 6 figs. Typical examples of reconstruction work.

Squaring Valves. A Short Cut in Squaring Locomotive Valves, William Ulrick. Ry. Mech. Engr., vol. 95, no. 2, Feb. 1921, pp. 123-124, 4 figs. Squaring valves without applying main rods and afterwards removing them.

LUBRICANTS

Tests. Flash and Fire Tests, their Importance, Lubrication, vol. 6, no. 11, Dec. 1920, pp. 9-12, 1 fig. Standard instruments for testing lubricants and methods of operation.

Viscosity. Tentative Lubricant Viscosity Progresses. Sci. Lubrication, vol. 1, no. 1, Jan. 1921, pp. 9 and 32. Tentative test for viscosity of lubricants adopted by Am. Soc. for Testing Matls.

Worm-Gear Efficiency. The Effect of Lubricants Upon Worm-Gear Efficiency, J. H. Hyde. Eng. & Indus. Management, vol. 5, no. 2, Jan. 13, 1921, pp. 46-48. Report of Lubricant & Lubrication Inquiry Committee of British Department of Scientific & Industrial Research.

LUBRICATING OILS

Carbonization. Carbonization of Lubricating Oils. Dept. of Commerce, Circula of Bur. of Standards, no. 99, Nov. 12, 1920, 44 pp., 4 figs. Nature of effects of deposits formed in internal combustion engines. It is known that term 'carbon" is a misnomer, because deposits consist largely of asphaltic matter. Accounts are given of nature of petroleum oils and of theories concerning formation of deposits.

The Carbonization of Lubricating Oils in Internal-Combustion Engines, Frederic H. Garner. Petroleum Times, vol. 5. no. 107, Jan. 22, 1921, pp. 93-95. Requirements of lubricating oils which with reduce carbonization in cylinder of internal-combustion engine to minimum. (Abstract.) Paper read before Instn. Petroleum Technologists.

Cold Test. A Cold Test Apparatus for Oils, G. H. P. Lichthardt. Jl. Indus. & Eng. Chem., vol. 13, no. 2, Feb. 1921, pp. 145-146, 1 fig. Apparatus used for lubricating oils at laboratory of Southern Pacific Railroad Co.

Testing Machine. Friction and Lubrication, R. Mountford Deeley. Engr., vol. 131, no. 3395, Jan. 21, 1921, p. 78, 1 fig. Deeley's oil-testing machine. Preliminary report communicated to Lubricants & Lubrication Inquiry Committee of Dept. of Sci. & Industrial Research.

LUMBER

Size Standardization. Standardization of Lumber Sizes and Grades, David G. White. Jl. Forestry, vol. 19, no. 1, Jan. 1921, pp. 34-35. Scheme of sizes recommended.

M

MACHINE TOOLS

Alignment. Correcting the Alignment of Machine Tools, F. Horner. Can. Machy., vol. 25, no. 4, Jan. 27, 1921, pp. 33-37, 12 figs. Methods of correcting alignment of spindles, slides, heads, cylindrical bearings, clamping devices, turrets and other parts of machine tools.

British. Notes on Improvements in British Machines, I. William Chubb. Am. Mach., vol. 54, no. 4, Jan. 27, 1921, pp. 141-145, 12 figs. Ten new types produced in last ten years. Changes in machine details. Special vs. general-purpose machines. Unusual planer drive.

Manufacture. Tool Plant Reflects New Ideas, Dand O. Taber. Iron Trade Rev., vol. 68, no. 5, Feb. 3, 1921, pp. 344-349, 11 figs. Description of machine tool plant in Cleveland, noting arrangements of equipment and facilities for handling materials.

Performance Record. Apparatus for Recording the Performance of Machine Tools (Ueber Kontrollschreibapparate für Arbeitsleistungen an Werkzeugmaschinen). F. Breitling. Werkstattstechnik, vol. 15, no. 2, Jan. 15, 1921, pp. 43-44, 5 figs. Details of the work-recording clock originally designed and employed by Dr. Poppelreuter in his nerve clinic for wounds in the head; curves recorded with this clock are said to give an excellent presentation of the efficiency of a workman as well as of the useful scope of a machine tool. Description of Harms control apparatus for recording operations of machine tools, etc.

Repetition Work. Machining Operations on Repetition Work—Part I. Eng. Production, vol. 2, no. 16, Jan. 20, 1921, pp. 76-81, 15 figs. Examples of modern practice in construction and operation of machine tools.

Safeguards. Guarding Machine Tools. Mech. World, vol. 69, no. 1775, Jan. 7, 1921, pp. 4-5. Forms and types of safe guards. (Abstract). Paper read before Industrial Safety Conference organized by the Home Office and British Industrial "Safety First" Association.

MAGNETS

Permanent. Permanent Magnets in Theory and Practice, S. Everahed. Jl. Instn. Elec. Engrs., vol. 28, no. 295, Sept. 1920, pp. 780-825 and (discussion) pp. 825-837, 33 figs. Theory of permanent magnetism combining Ampere's hypothesis of molecular currents with theory of interactions between magnetic molecules. Fundamental equations for magnets of uniform flux density, and their application to design of ordinary magnets of uniform sectional area.

MALLEABLE IRON

Cupola-Melted. Experiments on Cupola Malleable, F. H. Hurren. Foundry, vol. 49, no. 4, Feb. 15. 1921, pp. 135-138, 6 figs. Comparative study of cupola melted metal and air furnace product. Paper read before Birmingham Branch, Instn. British Foundrymen.

Metallography. American Malleable Cast Iron—III, H. A. Schwartz. Iron Trade Rev., vol. 68, no. 5, Feb. 3, 1921, pp. 353-357 and 361, 9 figs. Metallography of malleable iron.

Properties. American Malleable Cast Iron—IV, H. A. Schwartz. Iron Trade Rev., vol. 68, no. 7, Feb. 17, 1921, pp. 485-488, 7 figs. Tensile properties of malleable iron.

MANGANESE STEEL

Magnetic Mechanical Analysis. The Magnetic Mechanical Analysis of Manganese Steel, Robert Hadfield and S. R. Williams and I. S. Bowen. Proc. Royal Soc., vol. 98, no. A692, Jan. 3, 1921, pp. 297-302, 3 figs. Correlation of magnetic and mechanical properties of manganese steel.

Water-Tube. Water Tube Marine Boilers, W. M. McFarland. Gen. Elec. Rev., vol. 24, no. 2, Feb. 1921, pp. 115-119, 4 figs. Evolution and adoption of Babcock & Wilcox stationary boiler to render it suitable for use on board ship.
See also Boilers, Water-Tube.

MEASURING INSTRUMENTS

Tolerances. Weights and Measures, Dept. of Commerce, Bur. of Standards, miscellaneous publications, no. 43, 1921, 200 pp. Specifications and tolerances of measuring instruments. Thirteenth annual conference of representatives from various states held at Bur. of Standards, Washington, D. C., May 24-27, 1920.

METALS

Calorizing. Calorizing as a Protection for Metals, Arthur V. Fsrr. Iron Age, vol. 107, no. 4, Jan. 27, 1921, pp. 251-253, 9 figs. General Electric Co. process of protecting methods at high temperatures. Process of protecting methods at high temperatures. Process consists in placing material to be calorized in retort and heating in reducing atmosphere retort being filled with mixture containing finely divided aluminum. Treatment infuses aluminum into exposed portion of metal so as to form homogeneous aluminum alloy for certain depth.

Finish. Finish of Metallic Materials, Sidney Cornell. Chem. & Metallurgical Eng., vol. 24, no. 5, Feb. 2, 1921, pp. 209-212. Quality given by heat treatment contrasted with durability and appearance. Finish of metallic materials discussed as essential detail in modern manufacturing, with brief notes on cleaning, polishing, lacquering, coatings, slushes and wrapping.

METRIC SYSTEM

Arguments Against Adoption in U. S. Metric Bugaboo Again in Congress, C. C. Stutz. Am. Industries, vol. 21, no. 7, Feb. 1921, pp. 19-21, 2 figs. Criticism of bill for adoption of Metric system in U. S. introduced into Senate. Map of the world is presented and "commanding position of the English system" is indicated.

MILLING CUTTERS

Standards. British Standards for Milling Cutters and Reamers. British Eng. Standards Assn., no. 122, July 1920, 67 pp., 46 figs. Standards for non-relieved cutters, end mills, form-relieved cutters and reamers, determind as result of conference, research and co-operation between small tool makers, machine-tool makers and users of these tools in Great Britain.

MILLING MACHINES

Manufacture. Making One Thousand Milling Machine Saddles, Donald A. Hampson. Can. Machy., vol. 25, no. 6. Feb. 10, 1921, pp. 33-37, 15 figs. Equipment necessary to produce one thousand saddles every year. Pattern work is taken up, also various machining operations, cost of machine tools and other vital points.

Profile. Profile Milling. Eng. Production, vol. 2, no. 18, Feb. 3, 1921, pp. 170-172, 8 figs. Automatic profile-milling machine.

MINERS' LAMPS

British Government Order. Approved Safety Lamps for Mines. Colliery Guardian, vol. 121, no. 3134, Jan. 21, 1921, pp. 181-182, 7 figs. Types approved by British Government Safety Lamps Order issued in accordance with Coal Mines Act and regulating types to be used in coal mines.

Ventilation. Notes on Experiments on Ventilation Problems in Development Work on Mines, E. J. Laschinger. Jl. Chem., Metallurgical & Min. Soc. So. Africa, vol. 21, no. 5, Nov. 1921, pp. 78-82 and (discussion) pp. 82-84, 6 figs. Data as to amount of fresh air to clear out fumes after blasting.

MINING

Cementation. The Application of Cementation to Mining, H. Standish Ball. Proc. South Wales Inst. Engrs., vol. 36, no. 2, Jan. 21, 1921, pp. 517-574, 20 figs. Points out various phases of mining in which cementation can be used to advantage, specially drifting in fissured ground, sinking in fissured ground, and sinking in porous ground.

Standardization of Materials. The Standardization of Materials Employed in Mining and Milling Plant, E. A. Wraight. Bul. Instn. Min. & Metallurgy, no. 196, Jan. 1921, 13 pp. Efforts made by various mining companies, and suggestions further standardizing mining and milling materials.

Stripping Method. Some Observations on Mining by the Opencast or Stripping Method, R. E. Palmer. Bul. Instn. Min. & Metallurgy, no. 195, Dec. 1920, 13 pp., 10 figs. Advantages of stripping over underground mining.

Survey of 1920. Chronology of Mining in 1920. Eng. & Min. Jl., vol. 111, no. 4, Jan. 22, 1921, pp. 135-202. Survey of principal mining events of 1920 together with articles dealing separately with production, stocks, imports, exports and consumption of copper, pig lead, zinc, tin, gold silver, iron, manganese, etc., etc: as well as reviews of development in mining industry by states and territories and principal mining foreign countries, notably in the American continent. Articles are also included surveying metallurgical developments in copper metallurgy, lead smelting, gold and silver metallurgy, recent trends in ore dressing and progress in manufacture of ferroalloys.

MOLDING MACHINES

Hand-Power. Hand-Power Moulding Machine. Engineering, vol. 111, no. 2876, Feb. 11, 1921, pp. 164-166, 16 figs. Designed to be easily adjusted to take boxes and pattern plates of any size within comparatively wide range.

MONEL METAL

Properties. Monel Metal—II, Adolph Bregman. Metal Industry (N. Y.), vol. 19, no. 2, Feb. 1921, pp. 64-65, 4 figs. Summary of properties, methods of melting and casting, uses, handling and working in up-to-date practice of this natural nickel alloy.

Notes on Monel Metal, Paul D. Merica. Chem. & Metallurgical Eng., vol. 24, no. 7, Feb. 16, 1921, pp. 291-294, 3 figs. Physical properties of this natural alloy, and commercial uses to which it has been adapted. Its resistance to corrosion and its strength at high temperatures are perhaps most useful properties.

MOTOR TRUCKS

American-Made. Complete Mechanical Specifications of All Makes of 1921 Gasoline Motor Trucks. Motor Age, vol. 39, no. 4, Jan. 27, 1921, pp. 90-105. Details of 527 gasoline and one steam motor-truck chassis as produced by 176 American truck manufacturers.

MOTORSHIPS

Economical Advantages. Motorships, Charles Edward Lucke. Mech. Eng., vol. 43, no. 2, Feb. 1921, pp. 140-141. Economical advantages of motorship. Construction of motorships by European shipbuilding nations and its continued adoption in U. S.

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MUNICIPAL ENGINEERING

Canada. Municipal Engineering, R. O. Wynne-Roberts. Jl. Eng. Inst. of Canada, vol. 4, no. 2, Feb. 1921, pp. 110-114. Historical survey of various branches of municipal engineering, including water supply, sewage disposal and road construction, with tables of present day statistics relative to Canadian cities.

N

NAVIGATION

Electric Signals. Guiding of Ships at the Entrance of Ports and Canals by Immersed Electric Cable (Sur le guidage des navires à l'entrée des ports et chenaux par un câble électrique immergé), L. A. Herdt and R. B. Owens. Comptes rendus des Séances de l'Académie des Sciences, vol. 172, no. 1, Jan. 3, 1921, pp. 50-51. Researches conducted and installations built during war.

NICKEL

Properties. Chemical Properties and Metallography of Nickel, Paul D. Merica. Chem. & Metallurgical Eng., vol. 24, no. 5, Feb. 2, 1921, pp. 197-200, 4 figs. Data on solubility and magnetic transformation of pure nickel, also on effect of common impurities such as carbon, oxygen, manganese, sulphur, cobalt, iron and silicon upon various physical properties.

NICKEL-CHROME STEEL

Properties. Nickel-Chrome Steels. Machy. (Lond.), vol. 17, no. 433, Jan. 13, 1921, pp. 465-467. Chart showing tensile strength of nickel-chrome oil-hardening steel.

NOZZLES

Steam, Tests of. German Tests on Steam Nozzles and Diffusors. Steam, vol. 27 no. 1, Jan. 1921, pp. 8-9, 1 fig. Experiments carried out in laboratory of machine design of Technical High School, Charlottenburg, Germany. Translated from Zeitschrift des Vereines deutscher Ingenieure.

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OFFICE MANAGEMENT

Correspondence Filing. Some Suggestions on Office Correspondence Filing, Grant Gibson. Ry. Age, vol. 70, no. 7, Feb. 18, 1921, pp. 413-416, 5 figs. General, unit and sub-files and file book for cross reference facilitate locating letters.

OIL

Crude. Properties of Typical Crude Oils from the Eastern Producing Fields of the United States, E. W. Dean. Reports of Investigations, Dept. of Interior, Bur. of Mines, serial no. 2202, Jan. 1921, 57 pp. Specific gravity at 60 deg. fahr., sulphur percentage, water percentage, distillation at atmospheric pressure, vacuum distillation of residuum at 40 mm. absolute and Conradson carbon residue percentages.

See also Petroleum.

OIL ENGINES

Ingersoll-Rand. A New Development of the Heavy Oil Engine, F. A. McLean. Can. Machy., vol. 25, no. 3, Jan. 20, 1921, pp. 37-40, 4 figs. Principle of operation and structural details of Ingersoll-Rand, Price Rathbun type of heavy-oil engine.

Marine. 130-B. H. P. Bolnes Marine Oil Engine. Engineering, vol. 111, no. 2873, Jan. 21, 1921, pp. 70-72, 7 figs. Two-cycle hot-bulb Dutch-type engine resembling in general arrangement of steam marine engine.

Pistons. Casting and Machining Oil-Engine Pistons, Piston Rings and Cylinders, Samuel Rosswell. Am. Mach., vol. 54, no. 4, Jan. 27, 1921, pp. 137-140, 2 figs. Selection of materials. Vertical casting preferable. Heat treatment after rough-machining. Fitting piston pin. Assembling rings. Reaming vs. grinding cylinders.

Solid-Injection. Effect of Fuel Consumption on Oil-Engine Reliability, Ralph Miller. Power, vol. 53, no. 7, Feb. 15, 1921, pp. 272-273, 1 fig. Diagram from solid-injection engine.

OIL FIELDS

Exploitation by Shafts and Galleries. The Exploitation of Petroleum by Shafts and Galleries (De l'exploitation du pétrole par puits et galeries), N. A. Lykiardopoulo. Revue universelle des mines, vol. 8, no. 1, Jan. 1, 1921, pp. 38-45. Methods followed in exploitation of oil at Béchelbronn, Alsace.

OIL FUEL

Coal vs. The Use of Fuel Oil as Compared with the Firing of Coal by Means of Mechanical Stokers, F. H. Daniels. Steam, vol. 27, no. 1, Jan. 1921, pp. 5-8, 1 fig. Urges prohibiting use of oil fuel on land and restricting it to ships. Graph giving comparative fuel costs of coal and oil fuel.

Installations. Unusual Efficiencies in an Oil Fuel Installation, Joseph Poke and Frank G. Philo. Universal Engr., vol. 33, no. 1, Jan. 1921, pp. 29-33, 3 figs. Oil-burning tests results obtained at plant of Savannah Electric Co. From Stone & Webster Jl.

Uses. Fuel Oil, W. A. White. North-East Coast Instn. Engrs. & Shipbuilders, Advance paper, 23 pp., 4 figs. Uses of oil fuel, particularly in ships, notes on fire precautions and appliances, with data on world oil deposits and probable resources.

OIL SHALES

Industry. A Review of the Progress of the Oil Shale Industry in 1920, Victor C. Alderson. Am. Gas Eng. Jl., vol. 114, no. 4, Jan. 22, 1921, pp. 69-71 and 79-81. Progress in utilization of oil shale.

Retorting. American vs. Scotch Methods in Retorting of Petro-Shales, J. B. Jenson. Salt Lake Min. Rev., vol. 22, no. 20, Jan. 30, 1921, pp. 17-23, 12 figs. Pumpherston and Henderson types of retorts.

OPEN-HEARTH FURNACES

Controlling Valve for. A New Type of Controlling-Valve for Supplying Air and Gas Mixtures to Open-Hearth Furnaces, W. H. Wharton. Iron & Steel of Canada, vol. 4, no. 1, Feb. 1921, pp. 18-20, 3 figs. Reversing valve combined with air-pressure and volume-controlling mechanism.

OVERVOLTAGES

Protection. German Methods of Protection against Over Voltages and Heavy Currents (La protection contre les surtensions et les surintensités d'après les travaux allemands récents), H. Massing. Revue générale de l'Électricité, vol. 9, no. 4, Jan. 22, 1921, pp. 99-104, 10 figs. Developments in design of condensers, reactive coils and lightning arresters.

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Spray. Recent Development sin Spray Painting, Henry A. Gardner. Paint Manufacturers' Assn. of U. S., circular no. 114, Jan. 1921, 18 pp., 20 figs. Paper read before Pennsylvania State Assn. of Master Painters.

PAPER MANUFACTURE

Canada. The Canadian Pulp and Paper Industry, T. Linsey Crossley. Jl. Eng. Inst. of Canada, vol. 4, no. 2. Feb. 1921, pp. 98-101. Statistics of pulp and paper industry in Canada, historical development in Dominion, summary of processes for production of wood pulp, problems to be solved by industry.

PATTERNMAKING

Shop Organization. New England Pattern Shop is Unique, Herbert R. Simonds. Foundry, vol. 49, no. 4, Feb. 15, 1921, pp. 127-132, 13 figs. Plant is arranged as series of producing units each with its equipment complete. Progress of work is recorded by special system.

PAVEMENTS, ASPHALT

Specifications. Specifications for Asphalt Pavements. Can. Engr., vol. 40, no .4, Jan. 27, 1921, pp. 168-169. Prepared by Asphalt Assn. of Toronto and New York City.

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Deposits. Classification and Formation of Peat and Related Deposits, C. C. Osbon. Jl. Am. Peat Soc., vol. 14, no. 1, Jan. 1921, pp. 37-44, 4 figs. Distinction between peat and muck. Theory of formation of deposits.

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Clay. The Lateral & Vertical Pressure Effect of Piles in Clay, Henry R. Lordly. Jl. & Trans. Soc. Engrs., vol. 11, no. 7 1920, pp. 171-196, 9 figs. Tests carried out at Cornell University on action of pile in clay.

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Tests. Modern Cast Iron Pipe, A. F. Macallum. Public Works, vol. 50, no. 4. Jan. 22, 1921, pp. 75-76. Tests made at Toronto University on De Lavaud centrifugal cast-iron pipe

PIPE, SEWER

Service Strength. Service Strength of Sewer Pipes. Public Works, vol. 50, no. 7, Feb. 12, 1921, pp. 146-148. Relative effects that different methods and conditions of laying pipe have upon strength of sewer, as laid, to support exterior loads. Conclusions from tests made by engineering experiment station of Iowa State College. Effect of sand bed and concrete cradle.

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Durability. Observations Relative to Woods tave Pipe, W. A. Scott. Eng. World, vol. 18, no. 2, Feb. 1921, pp. 77-81, 6 figs. Durability as indicated by pipe records. Characteristics of redwood as material for pipe lines. Notes on installations.

PIPE LINES

Steam. Long Distance High-Pressure Steam Line. Power Plant Eng., vol. 25, no. 3, Feb. 1, 1921, pp. 157-159, 9 figs. Lines carry steam on pressure of 175 lb. per sq. in. total distance of about 3000 ft.

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Toolroom. Gorton Toolroom Planer, J. V. Hunter. Am. Mach., vol. 54, no. 7, Feb 17, 1921, pp. 257-259, 3 figs. Especially designed for work on dies, jigs and fixtures. Built in two sizes. Furnished with side head. Special features and specifications.

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Screw Fastenings. Strength Tests of Screw Fastenings of Plywood, H. S. Grenoble Aerial Age, vol. 12, no. 21, Jan. 3, 1921, pp. 535-536. Tables showing screws required for maximum strength, based on tests carried out at Forest Products Laboratory, Madison, Wis.

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Latticed. Calculations of Latticed Poles of Minimum Weight (Calcolo rapido dei pali a traliccio di peso minimo), Marco Semenza. Eletrotecnica, vol. 7, no. 36, Dec. 25, 1920, pp. 640-645, 3 figs. Design equations and graphs.

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New York, Reorganization of. Proposed Reorganization of the Port of New York. Ry. Age, vol. 70. no. 4, Jan. 28, 1921, pp. 269-274, 3 figs. Special automatic-electric subway recommended by New York-New Jersey Port and Harbor Development Commission.

POWER GENERATION

Gas vs. Electricity. Note on the Thermal Efficiency of the Generation and Use of Gas and Electricity, Dugald Clark. Jl. Instn. Elec. Engrs., vol. 28, no. 295. Sept. 1920, pp. 765-767 and (discussion), pp. 767-779, 1 fig. Ratio of utilized heat units by electricity into utilized heat units by gas for power purposes was found in experiments to be 1.6. This ratio was 4 for heat production and 0.84 for light.

Thermal Springs. The Utilization of Thermal Springs as Source of Energy (L'emploi des eaux thermales comme source d'énergie), P. Caufourier. Génie Civil, vol. 78, no. 2. Jan. 8, 1921, pp. 37-39, 2 figs. Installation at Algiers.

POWER PLANTS

Accounting. Armour System of Power-Plant Accounting, O. A. Anderson. Power, vol. 53, no. 4, Jan. 25 1921, pp. 128-131, 1 fig. System of records and accounting from which cost figures are deduced and analyses made of plant operations. Motive-power department has under its supervision 72,000 hp. in boilers burning nearly 900,000 tons of coal and 700,000 bbl. of oil per year.

POWER TRANSMISSION

Hydraulic. Hydraulic Transmission of Power (La transmission hydraulique), A. Raudot. Revue générale de l'Electricité, vol. 9, no. 5, Jan. 29, 1921, pp. 143-147, 4 figs. Technical study of principles of transmission of power by means of fluid, and survey of mechanisms which have been developed for this purpose. (To be continued.)

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Feeding Devices. Littell Automatic Punch-Press Feeding Devices, J. V. Hunter. Am. Mach., vol. 54, no. 6, Feb. 10, 1921, pp. 209-212, 9 figs. Automatic feed to increase output and safeguard workmen. Construction of attachments for feeding from roll. Dial, slide and hopper feeding mechanisms.

PRESSWORK

Universal-Joint Covers. Making a Sheet-Steel Universal Joint Cover, W. A. Flumerfelt. Am. Mach., vol. 54, no. 5, Feb. 3, 1921, pp. 171-173, 9 figs. Methods of drawing and forming articles of comparatively thick sheet metal. Flanging and closing-in by means of sectional dies.

PROFIT SHARING

England. A History of Profit Sharing in the British Isles, W. Wallace. Indus. Management, vol. 61, no. 3, Feb. 1, 1921, pp. 85-89. Analysis and summary of recent report by English Ministry of Labor.

Experiences. Promoting Efficiency in Industrial Plants. Iron Age, vol. 107, no. 4, Jan. 27, 1921, p. 267. Cleveland Chamber of Commerce publishes results of survey of 600 companies and study of profit sharing in various forms.

Legislation. Profit Sharing in France (La participation ouvrière aux bénéfices de la production), Paul Razous. Génie Civil, vol. 78, no. 3, Jan. 15, 1921, pp. 59-61. Survey of legislation and practices in Government establishments. (To be continued.)

PULVERIZED COAL

Boiler Firing. Engineers Afforded Latest Information on Powdered Coal and Briquets, R. Dawson Hall. Coal Age, vol. 19, no. 1, Jan. 6, 1921, pp. 16-17. Results of boiler trials made at pulverized fuel plant, Lykens, Pa.

Some Comments on Pulverized Coal for Power Plants, Frederick A. Scheffler. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 27, no. 1, Jan. 1921, pp. 7-13, 3 figs. Typical applications of pulverized coal to Babcock & Wilcox boiler and to Stirling boiler.

Heating Furnaces. Experience with Powdered Coal for Heating Furnaces, Charles Longenecker. Forging & Heat Treating, vol 7, no 1, Jan 1921, pp. 86-88, 4 figs. Advantages of powdered coal for heating and forging furnaces.

Quigley System. Pulverized Coal, Ralph H Cridge. Elec. Times, vol 59, no 1526, Jan. 13, 1921, pp. 25-28, 7 figs. Quingley system of burning pulverised coal

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PUMPS, CENTRIFUGAL

Submersible. The Submersible Pump, R. C. Bill. Managing Engr , vol. 7, no. 9, Jan. 1921, pp. 165-172, 6 figs Submersible electric motor pump used by British Admiralty Salvage Section during war.

Wilfley. The Wilfley Centrifugal Pump. Engr., vol. 131, no 3396, Jan. 28, 1921, p. 96, 1 fig. Also in Eng , vol 111, no. 2874, Jan. 28, 1921, p. 116, 4 figs. Impeller is formed with large hollow trunnion, through which suction water flows on its way to impeller passages.

R

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Failures. Report of Committee IV—On Rail. Bul. Am. Ry. Eng. Assn., vol. 22, no. 231, Nov. 1920, pp. 197-215, 13 figs. Report of rail failures, with statistics and conclusions as to costs. Suggestions for improvements in rail steel.

Shallow-Head vs. Deep-Head. Shallow-Head and Deep-Head Rails Compared, George H. Tinker. Ry. Maintenance Engr., vol. 17, no. 2, Feb. 1921, pp. 52-53. Service records show longer life of 14 months for shallow-heads than for deep-head rails.

RAILWAY ELECTRIFICATION

Illinois Central. The Illinois Central Electrification Project. Elec. Traction, vol. 17, no. 1, Jan. 1921, pp. 1-5, 4 figs. Ordinance regarding electrification of Chicago terminals of Illinois Central Railroad has been passed by Chicago city council and accepted by Illinois Central Railroad Co.

India. The Electrification of Indian Railways. Ry. Engr., vol. 42, nos. 492 and 493, Jan. and Feb. 1921, pp. 12-16, 7 figs. and 56-59, 7 figs. Advantages of electric locomotives as compared with steam locomotives on heavily-graded sections of North Western Railway of India.

Sweden. Electrification of the Stockholm-Saltsjobaden Railway (L'électrification du chemin de fer de Stockholm à Saltsjobaden Suède), Revue générale de l'Electricité, vol. 9, no. 4, Jan. 22, 1921, pp. 115-117, 2 figs. Direct current of 1200 volts used.

Switzerland. Electrification Work in Switzerland, Engr., vol. 131, no. 3396, Jan. 28, 1921, pp. 95-96. Notes on projects under consideration.

RAILWAY OPERATION

Accounting. How a Railway Simplified Its Disbursements Accounting, C. O. Price. Ry. Rev., vol. 68, no. 4, Jan. 22, 1921, pp. 134-140, 7 figs. Labor-saving devices.

Train Control. Auto-Train Control Gear, Great Eastern Railway. Ry. Gaz., vol. 34, no. 1, Jan. 7, 1921, pp. 20-21, 2 figs. Explanation of regulator and brake operating and control connections.

RAILWAY SHOPS

Safety Devices. Railroad Shop Safety Devices, Frank A. Stanley. Am. Mach., vol. 54, no. 5, Feb. 3, 1921, pp. 184-186, 9 figs. Common sources of accidents on erecting floor. Used of safety screens. Saw bench and boring bit guards

RAILWAY TIES

Reinforced-Concrete. A New Reinforced Concrete Railroad Tie. Eng. & Contracting, vol. 55, no. 7, Feb. 16, 1921, p. 164, 1 fig. Patented rail fastener is feature. Bolts are removable.

Steel. Steel Sleepers on the North Eastern Railway Ry. Engr., vol. 42, no. 493, Feb. 1921, pp. 55, 3 figs. Inverted U-shapped plates supporting rails fit into channel-shaped steel ties.

RAILWAY TRACK

Concrete. Device for Holding Down Rails to Concrete Foundations. Engr., vol. 131, no. 3397, Feb. 4, 1921, pp. 131-132, 6 figs. Wooden templates fitted in conical coal.

RAILWAYS

Trans-Australian. The Trans-Australian Railway, J. J. Poynton. Ry. Gaz., vol. 34. no. 1, Jan. 7, 1921, pp. 15-19, 9 figs. Notes on construction and operation.

World Mileage. Railway Mileage of the World, Ry. Age, vol. 70, no. 6, Feb. 11, 1921, p. 367. Grand total is 706,730 miles. From Archiv für Eisenbahnwesen.

RAPID TRANSIT

Philadelphia. Substantial Energy Saving on Philadelphia Rapid Transit Elect Ry. Jl , vol 57, no. 8, Feb 10, 1921, pp. 355-360, 9 figs. Cars are equipped with meters which are used both for economical operation and for timing inspections. Instructors explain to men methods to be used in order to reduce amount of power consumed Records posted in trainmen's quarters, resulting in great rivalry to keep records low

REAMERS

Ball-Joint. Tools for Locomotive Steam Pipe Joints, Frank A Stanley Am Mach., vol. 54, no. 6, Feb. 10, 1921, pp 218-220, 8 figs. Type of ball-joint reamer for steam-pipe work on locomotives

REDUCTION GEARS

Design. New Geared Turbine Set. Power, vol 53, no 5, Feb 1, 1921, p. 187, 2 figs Turbine element is mounted directly on gear housing making one rigid frame for turbine and gear.

REFRACTORIES

Tests. Refractories and Their Relation to Furnaces. Blast Furnace & Steel Plant, vol. 9, no. 1, Jan. 1921, pp. 53-54 and 78. Tests or refractories under various conditions of slag penetration.

RELAYS, A. C.

Testing. Testing Alternating-Current Relays, Victor H. Todd. Power, vol 53, no. 3, Jan. 18, 1921, pp. 98-101 9 figs Methods of testing and adjusting both current and voltage relays. Equipment for use in making tests Schemes for obtaining tests loads. How adjustments are made. Tabulation of test data.

RESEARCH

Co-ordination in. Research Laboratory Adopts Modern Management, C. V. Maudlin. Indus. Management, vol. 61, no. 3, Feb. 1, 1921, pp. 98-102 5 figs. Plan of record and control adopted at Forest Products Laboratory, U. S. Forest Service.

Rating. Rating of Household Refrigerating Machines, R. F. Massa. A.S.R.E. Jl , vol. 6, no. 6, May 1920, pp. 432-436. Survey of practices.

REFRIGERATION

Standard Unit of. Standard Unit Adopted by the Refrigerating Industry, F. E. Matthews. Power, vol. 53, no. 5, Feb. 1, 1921, pp. 184-187, 1 fig. Am. Soc. of Refrigerating Engrs. has adopted recommendations of joint committee fixing "Standard Unit of Refrigeration" as equivalent of absorption of 288,000 B.t.u. of heat.

See also Ammonia Absorption Refrigerating System, Non-Condensible, Gases in.

Government-Operated. Scientific and Engineering Work of the Government, E. B. Rosa. Mech. Eng., vol. 43, no. 2, Feb. 1921, pp. 111-118, 6 figs. Survey of government research work and its economical significance and cost.

Industrial and Scientific. A Reading List on Scientific and Industrial Research and the Service of the Chemist to Industry, Clarence Jay West. Reprint & Circular Series of Nat. Research Council, no. 9, April 1920. 45 pp. Articles on industrial and scientific research.

Industrial Research, Frank B. Jewett. Reprint and Circular Series of Nat. Research Council, no. 4, 16 pp. Urges promotion of industrial research. Paper read before Royal Can. Inst.

Research Laboratories in Industrial Establishments of the United States of America, Alfred D. Flinn, A. J. Porskievies and Ruth Cobb. Bul. Nat. Research Council, vol. 1, part 2, no. 2, March 1920, pp. 45-130. Classified list with information on staff, work and equipment.

Research in Industrial Conservation, H. E. Howe. Gas Age, vol. 47 no. 2, Jan. 25, 1921, pp. 42-44. Importance of research in securing increased production, conservation of supplies and selection of best materials and methods.

Machinery. Completes Laboratory for Research in Machinery. Iron Trade Rev., vol. 68, no. 2, Jan. 13, 1921, pp. 152-153, 4 figs. Mechanical laboratory designed for research work in machinery, installed at Nat. Lamp Works of Gen. Elec. Co., Cleveland.

Organization of. An Industrial Research Association, Arthur W. Crossley. Chem. Age (Lond.), vol. 4, no. 83, Jan. 5, 1921, pp. 73-74. Advantages of co-operative laboratory research in industry.

The Organization of Research, William Morion Wheeler. Science, vol. 53, no. 1360, Jan. 21, 1921, pp. 53-67. Deprecates organization of research because research, to be successful, must be carried out in a manner to permit full development of personality and individual initiative, manifestations which cannot take place if investigator is merely a part of an organized machanism.

RESERVOIRS

Concrete. Concrete Oil Reservoir with Flat-Slab Roof and Floor, Eugene E. Halmos. Eng. News-Rec., vol. 86, no. 6, Feb. 10, 1921, pp. 260-263, 7 figs. Reinforced-concrete underground fuel-oil reservoir at Three Rivers, Quebec. Concrete was mixed by weight and special joints were used to provide for expansion.

RIVETS

Electric Heaters for. Electric Rivet Heaters. Ry. Engr., vol. 42, no. 492, Jan. 1921, pp. 23-24, 1 fig. Data on power consumption.

ROAD CONSTRUCTION

Canada. Highway Administration and Road Conditions in Canada. Public Roads, vol. 3, no. 29, Sept. 1920, pp. 13-16 and 22, 1 fig. Character and relations of national and local governments.

Comparative Types. Highway Road-Construction, William E. Williams. Jl. Soc. Automotive Engrs., vol. 8, no. 2, Feb. 1921, pp. 163-166, 12 figs. comparative study of various types of pavements for automobile traffic.

Curve. Superelevated Curve Practice on Minnesota Highways. Eng. News-Rec., vol. 86, no. 5, Feb. 3, 1921, pp. 220, 1 fig. Table giving offsets and areas for extra widening of curves on pavement.

Saskatchewan. Saskatchewan's Highway System. Contract Rec., vol. 35, no. 3, Jan. 19, 1921, pp. 56-57, 1 fig. Roads to be constructed under Canada's Highway Act.

ROADS

Direction and Danger Signs. Road Direction Posts and Danger Signs. Surveyor, vol. 59, no. 1512, Jan. 7, 1921, pp. 3-4, 3 figs. Standard types recommended by British Ministry of Transport.

Maintenance. Roads and Vehicle Maintenance, R. E. B. Crompton. Automobile Engr., vol. 11, no. 146, Jan. 1921, pp. 29-31, 1 fig. Compilation of data on road maintenance from technical press.

ROLLING MILLS

Efficiency of. The Economics of Roll Trains, A. Dyckerhoff. Iron-Trade Rev., vol. 68, no. 4, Jan. 27, 1921, pp. 279-282, 8 figs. Closer study of roll pass design as procedure to increase overall efficiencies of rolling mills.

Electric Drive. Electrical Review Steel Industry for 1920, G. E. Stolz. Blast Furnace & Steel Plant, vol. 9, no. 1, Jan. 1921, pp. 4-5. Steam driven mills rapidly being replaced by progressive application of electricity to steel mill drives. Number of instances shown where steam equipment is being replaced.

Recent Developments in Electric Mill Drive. Blast Furnace & Steel Plant, vol. 9, no. 1, Jan. 1921, pp. 93-94. Practically all new reversing mills built during 1920 are electrically-driven mills. Most interesting reversing-mill drive of year built for Tata Iron & Steel Co., at Temshedpur, India.

Plate Mills. Rolls Ship Plates on New Mill, Joseph Horton. Iron Trade Rev., vol. 68, no. 6, Feb. 10, 1921, pp. 410-412, 4 figs. English works where product is transferred from hot bed to shears by moveable runout table which controls plate while its ends are being trimmed.

Rotary Side-Cutting Shear for Three-High Plate Mill. Engr., vol. 131, no. 3397. Feb. 4, 1921, pp. 124 and 129-130, 8 figs., partly on supp. plate. Mill has top and bottom rolls 36 in. diameter and middle roll of 24 in. diameter all 9 ft. long on barrel and is designed to roll plates from ⅛ in. to 1½ in. thick up to length of 60 ft. and maximum shearing width of 8 ft. 6 in. maximum, weight of finished plate being 5 tons.

The Dominion Iron and Steel Company's New Ship Plate Rolling Mill, Barton R. Shover, Blast Furnace & Steel Plant, vol. 9, no. 4, Jan. 1921, pp. 80-84, 4 figs. Electrically driven mill in which electric motors are used for practically all work in plant.

Variable-Section Shapes. Continuous Die Forming, G. R. Norton. Blast Furnace & Steel Plant. vol. 9, no. 1, Jan. 1921, pp. 104-106, 4 figs. Also in Forging & Heat Treating, vol. 7, no. 1, Jan. 1921, pp. 30-32. New process designed to roll variable section shapes at Neville Island plant of Witherow Steel Co. Products to be manufactured in alloy and special steels.

ROPES

Winding. Deformation in Winding Ropes, H. Herbest. Quarry, vol. 26, no. 287, Jan. 1921, pp. 17-21, 6 figs. Formulas for determining stresses. Translated from Glückauf.

S

SCIENTIFIC MANAGEMENT

See Industrial Management.

SEWAGE DISPOSAL

Activated Sludge. Experiments with Modified Activated Sludge Process at Mount Vernon, N.Y. Eng. & Contracting, vol. 55, no. 2, Jan. 12, 1921, pp. 31-32, 6 figs. Dorr-Peck process developed in experimental plant.

New Activated Sludge Experiments. Can. Engr., vol. 40, no. 4, Jan. 27, 1921, pp. 172-173, 3 figs. Conducted at stoke-on-Trent during past two years, dealing with trade waste from potteries.

The Activated Sludge Process of Sewage Disposal, George G. Nasmith. Jl. Eng. Inst. of Canada, vol. 4, no. 2, Feb. 1921, pp. 114-116. Description of process, with discussion of advantages, disadvantages, present tendencies in sludge problem and question of by-products.

SEWER CONSTRUCTION

Costs. Methods and Cost of Excavating for Small Sewers in Rock, D. B. Davis. Mun. & County Eng., vol. 60, no. 1, Jan. 1921, pp. 4-5. Graphs showing cost of sewer excavation.

SHAFTS

Bending of. Theoretical Consideration of Bending in Shafts, Charles W. Good. Mech. Eng., vol. 43, no. 2, Feb. 1921, pp. 138-139. Computation of pressure distribution of loads and reactions, and effect of various distributions.

Critical Speeds. The Calculation of Critical Torsional Speeds (Beiträge zur Berechnung kritischer Torsions-Drehzahlen), Fr. Sass. Zeit. des Vereines deutscher Ingenieure, vol. 65, no. 3, Jan. 15, 1921, pp. 67-69, 9 figs. Describes method said to greatly simplify the tedious calculation of the critical torsional speed of multiple-crank engines. It is based on the combination of any number of small masses into a single equivalent mass of a given magnitude varying with the number of oscillations. Numerical tables are given for the rapid determination of the reduced length of cranked portion of shaft.

The Critical Speed of a Turbine Spindle, Richard Gardner. Engineering, vol. 111, no. 2874, Jan. 28, 1921, pp. 99-100, 1 fig. Method of obtaining formula for motor which is roughly symmetrical about its middle, taking common case of rotor formed by wheels carried on spindle, diameter of which is stepped.

Multiple-Splined. Torsional Strength of Multiple-Splined Shafts, C. W. Spicer. Jl. Soc. Automotive Engrs., vol. 8, no. 2, Feb. 1921, pp. 129-130 and 199, 4 figs. Comparative torsional tests of splined shafts and full round shafts.

SHIPBUILDING

1920. Naval Construction in 1920. Engr., vol. 131, no. 3393, Jan. 7, 1921, pp. 16-18. Statistics of shipbuilding throughout world.

SHIP PROPULSION

Turbine vs. Electric Drive. Electric Ship Propulsion, W. L. R. Emmet. Mar. Eng., vol. 26, no. 1, Jan. 1921, pp. 44-45. Comparison of electric propulsion with geared turbine drive in merchant vessels.

SHIP PROPULSION, ELECTRIC

Cargo Ships. Alternating-Current Generators for Ship Propulsion, E. H. Freiburghouse. Gen. Elec. Rev., vol. 24, no. 2, Feb. 1921, pp. 137-140. Equipment built by Gen. Elec. Co. for cargo boats.

Measuring Instruments. Special Electric Instruments for Electric Driven Ships, A. H. Mittag. Gen. Elec. Rev., vol. 24, no. 2, Feb. 1921, pp. 195-197, 3 figs. Excitation indicator and field temperature indicator used on U.S.S. New Mexico, S. S. Eclipse and S. S. Cuba.

Welded. Progress of Welding in the Shipyards, William T. Bonner. Mar. Eng., vol. 26, no. 1, Jan. 1921, pp. 57-65, 18 figs. Records of electric arc-welding work at shipyard of Bethlehem Shipbuilding Corp.

SHORE PROTECTION

Groyne System. Shore Protection on Lake Ontario by a Groyne System, John Taylor. Contract Rec., vol. 35, no. 4, Jan. 26, 1921, pp. 79-81, 7 figs. Erosion effectively prevented and beach built up by groynes consisting of steel H-beam piles and fir timbers.

SNOW REMOVAL

Highways. Snow Removal and Drift Prevention on Highways, George H. Bil. Eng. News-Rec., vol. 86, no. 5, Feb. 3, 1921, pp. 203-232, 4 figs. Principles and practices of Pennsylvania Highway Department developed during two years of successful snow fighting.

SPRINGS

Calculations. Derivation of Formulæ for Spring Calculations, Machy. (Lond.), vol. 17, no. 434, Jan. 20, 1921, pp. 485-488, 3 figs. Illustrations of procedure in various cases.

STANDARDS

Automotive Industry. Standards Committee Meeting. Jl. Soc. Automotive Engrs., vol. 8, no. 2. Feb. 1921, pp. 169-199, 16 figs. Proposed standards for ball bearings, electrical equipment, engine parts, etc.

STEAM

Properties. The Properties of Steam. Engineering, vol. 111, nos. 2873 and 2874, Jan. 21 and 28, 1921, pp. 63-65 and 93-94, 1 fig. Review of Callender's work. Jan. 21: Thermodynamic theory of vapor and application of vapor conclusions to steam. Jan. 28. Properties of steam near critical point. (Concluded.)

STEAM POWER PLANTS

Costs. Effect of Load Factor on Steam-Station Costs, Peter Junkersfeld. Mech. Eng., vol. 43, no. 2, Feb. 1921, pp. 108-110, 4 figs. Financial loss will result whenever it becomes necessary to operate power station at substantially higher or lower annual load factor than that for which station was properly designed. Load factor should be carefully considered in locating central station as well as in selection of equipment. Curves are given to show relative generating costs and boiler rating as affected by load factor, typical week-day load curves and load factors, and load factor as it occurs from day to day and month to month.

STEAM TURBINES

Design. A New Graphic Method for the Calculation of Steam Turbines (Om Turbomaskiner), Matts Bäckström. Teknisk Tidskrift (Mekanik), vol. 50, no. 11, Nov. 10, 1920, pp. 149-166, 22 figs. 3 on 3 supp. plates. Author discusses basic formulas and principles for the calculation of turbines and explains diagram developed by him and called the temperature-drop diagram, by use of which it is possible to make calculations in a purely mechanical and simple manner.

Developments. Development of the Steam Turbine. Robert June. Blast Furnace & Steel Plant, vol. 9, no. 1, Jan. 1921, pp. 61-64, 2 figs. Development has taken place not only with respect to design of turbines, but in particular with respect to very great increase in their application to different services.

Specifications. British Standard Specification for Steam Turbines for Electrical Plant. British Eng. Standard Assn., no. 132, Oct. 1920, 8 pp., 3 figs. Technical provisions for supply of machines. Method of measuring temperature of steam.

STEEL

Aircraft Steels. *See Aircraft Construction Materials, Steels.*

Alloy. *See Alloy Steels.*

Bars, Weight of. Weight Table for Estimating, F. W. Salmon. Am. Mach., vol. 54, no. 5, Feb. 3, 1921, pp. 182-183, 1 fig. Table giving weight of round steel bars per linear inch.

Basic Open-Hearth. The Basic Open Hearth Melting Shop Equipment and Practice in England, George A. V. Russell. Blast Furnace & Steel Plant, vol. 9, no. 1, Jan. 1921, pp. 31 and 38-45, 4 figs. Review of mixer plant and practice, melting furnaces, metallurgical practice, handling of materials and products and layout of plant. (To be concluded.)

Bibliography. Review of Iron and Steel Literature, 1920, E. H. M'Clelland. Forging & Heat Treating, vol. 7, no. 1, Jan. 1921, pp. 8-10. Also in Blast Furnace & Steel Plant, vol. 9, no. 1, Jan. 1921, pp. 6-8. List of important publications during 1920, with a few of earlier date compiled by librarian of Carnegie Library of Pittsburgh.

Bluing and Browning. Bluing and Browning Steel Articles, Sidney Cornell. Chem. & Metallurgical Eng., vol. 24, no. 7, Feb. 16, 1921, pp. 301-303. Commercial methods of producing oxidized finish on polished steel objects, including analyses of several browning solutions in use in various establishments.

Gases in. Gases Obtained in Molten Steel—I, Henry D. Hibbard. Blast Furnace & Steel Plant, vol. 9, no. 1, Jan. 1921, pp. 51-53. Classification of gases and how to deal with them in order to make product sound. (To be continued.)

High-Speed. *See Steel, High-Speed.*

Ingot Production. A Proposed New Ingot Mold of Steel, Robert C. Woodward. Iron Age, vol. 107, no. 4, Jan. 27, 1921, pp. 262-263, 2 figs. Cracks in ingots and their causes. Effect of heavy molds. Advantages of thin walls cooled by water.

Magnetic Reluctivity. Magnetic Reluctivity Relationship as Related to Certain Structures of a Eutectoid-Carbon Steel, C. Nusbaum, W. L. Cheney and H. Scott. Dept. of Commerce, Sci. Papers, Bur. of Standards, no. 404, Nov. 26, 1920, pp. 739-757, 7 figs. Changes in physical properties resulting from thermal treatment were studied for one percent carbon steel and it was found that very rapid rise of maximum and residual induction and even more pronounced decrease in coercive force occur between drawing temperatures of 150 and 250 deg. cent. Such changes very likely mark transformation from martensite to troostite.

Manganese. *See Manganese Steel.*

Metallography. Metallographic Methods for Determining the Nature of Non-Metallic Inclusions in Steel and Cast Iron (Méthodes métallographiques pour déterminer la nature des inclusions non métalliques contenues dans l'acier, le fer et la fonte), M. M. Matveieff. Revue de Métallurgie, vol. 17, no. 11, Nov. 1920, pp. 736-752, 25 figs. Comparative value of different etching reagents.

Microstructure. Notes on the Microstructure of Annealed Soft Steel, with Special Reference to Phosphorus in Tin Plate, Geo. F. Comstock. Forging & Heat Treating, vol. 7, no. 1, Jan. 1921, pp. 60-63, 16 figs. Interpretation of photomicrograph.

Nickel-Chrome. *See Nickel-Chrome Steel.*

Phosphorus and Sulphur. Effect of Phosphorus and Sulphur on Steel, E. W. Rettew and L. A. Lanning. Trans. Am. Soc. for Steel Treating, vol. 1, no. 4, Jan. 1921, pp. 247-249. Phosphorus increases tensile strength without decreasing ductility and increases hardness without lowering electric conductivity. Sulphur increases susceptibility to corrosion.

Tool. High Carbon Open-Hearth Steel Versus Crucible Tool Steel in the Manufacture of Miscellaneous Tools, George Porteous. Trans. Am. Soc. for Steel Treating, vol. 1, no. 4, Jan. 1921, pp. 238-244, 5 figs. Open-hearth high-carbon steel with proper heat treatment gives as good results as are given by higher grade and more expensive tool steel.

Uranium. *See Alloy Steels, Uranium Steel.*

Wrought Iron vs. Single Refined Wrought Iron Versus Steel, V. E. Hillman. Forging & Heat Treating, vol. 7, no. 1, Jan. 1921, pp. 63-65, 8 figs. Argument in favor of feasibility of substituting soft basic open-hearth steel for single-refined wrought iron.

STEEL CASTINGS

Annealing. Annealing Steel Castings with Fuel Oil, R. R. Hillman. Iron Age, vol. 107, no. 4, Jan. 27, 1921, pp. 247-249, 1 fig. Design and operation of new furnace in plant of Atlas Steel Casting Co. Blast for combustion heated by outgoing gases.

Electric Melting. Electricity Shop's Sole Heat Source, H. E. Diller. Foundry, vol. 49, no. 3, Feb. 1, 1921, pp. 87-91, 8 figs. Equipment installed at foundry of Emery Steel Castings Co., Baltimore, which specializes in light castings of intricate design.

Molding Sand for. Sand Plays Part in Poor Castings, R. J. Doty. Foundry, vol. 49, no. 3, Feb. 1, 1921, pp. 95-97. Clean, smooth steel castings are dependent upon facing and heap sand used. Close heap sand causes blows. Ten parts heap sand mixed with one part new sand in facing. Paper read before Am. Foundrymen's Assn.

Specifications. Meet Steel Castings Specifications, J. R. Young. Foundry, vol. 49, no. 4, Feb. 15, 1921, pp. 152-154. Work done under U. S. Ordnance Departments specifications. Table showing effect of various amounts of titanium on physical properties. Paper read before Am. Foundrymen's Assn.

Strength. Steel Castings of High Strength and Toughness, H. Federico Giolitti. Chem. & Metallurgical Eng., vol. 24, no. 4, Jan. 26, 1921, pp. 161-165, 15 figs. Data on improvement to be expected after properly heat-treating steel castings with illustrative tests on strong, tough castings which have replaced forgings on gun mounts.

STEEL, HEAT TREATMENT OF

Electric. Electric Heat Treating at Emery Steel Casting Company, F. W. Brooke and Geo. P. Mills. Forging & Heat Treating, vol. 7, no. 1, Jan. 1921, pp. 45-47, 5 figs. Electrically-heated core oven and annealing furnace for small intricate castings. High operating efficiency and low initial cost claimed for electric process.

Heat-Treating Department. Constructing a Heat Treating Department, L. C. Dunn. Forging & Heat Treating, vol. 7, no. 1, Jan. 1921, pp. 40-45, 7 figs. Commercial heat-treating department built by Montgomery Chemical Works, Detroit.

Methods. Metallography and Heat Treating of Steels, Wm. J. Merten. Blast Furnace & Steel Plant, vol. 9, no. 1, Jan. 1921, pp. 114-118, 15 figs. Review of various types of heat treatment. Photomicrographs.

STEEL, HIGH-SPEED

Manufacture. High-Speed Steel Manufacture in Sheffield, Paul M. Tyler. Iron Age, vol. 107, no. 6, Feb. 10, 1921, pp. 371-374. Great expansion in war time. Present practice, costs, prices and raw material sources. Wages much below American.

STEEL INDUSTRY

Germany. Development of the Steel Industry During the War in Germany—II, Hubert Hermanns. Blast Furnace & Steel Plant, vol. 9, no. 2, Feb. 1921, pp. 146-150, 2 figs. Utilization of basic open-hearth slag.

STEEL MANUFACTURE

Basic Open-Hearth Process. Basic Open-Hearth Melting Shop Equipment and Practice, G. A. V. Russell. Iron & Coal Trades Rev., vol. 102, nos. 2759 and 2761, Jan. 14 and 28, 1921, pp. 37-39, 3 figs., and 122-124, 3 figs. Rapid growth of basic open-hearth process in attributed to its suitability for dealing with pig irons of widely varying composition. Comparative developments of mixer practice in England and other countries. Metallurgical practice at representative British steel works. (To be continued.)

STEEL WORKS

Power Plants. Recent Developments in Steel Works Power Plants, W. N. Flanagan. Blast Furnace & Steel Plant, vol. 9, no. 1, Jan. 1921, pp. 56-59, 1 fig. Steps taken to reduce labor and consumption of coal.
See also Rolling Mills.

STOKERS

Automatic. Developments in the Design of Automatic Mechanical Stokers (Note sur quelques perfectionnements des foyers à grille-chaîne tournante), A. Lambotte. Société Belge des Electriciens, vol. 34, Nov.-Dec. 1920, pp. 253-260, 3 figs. Use of automatic stokers for burning low-grade coals.

Reconstruction. Remodeling Stokers and Furnaces Adds to Capacity, T. A. Marsh. Elec. World, vol. 77, no. 4, Jan. 22, 1921, pp. 196-197, 4 figs. Boiler ratings raised 39 per cent by enlarging grate areas and improving arch design. Practical method at minimum cost.

Operation. Train Operation in New Jersey. Elec. Ry. Jl., vol. 57, no. 7, Feb. 12, 1921, pp. 319-321, 10 figs. After tests covering various operating conditions, in which research work was done and both theoretical and practical aspects of subject were given full consideration, public service railway adopts trailer operation on large scale. Details of recent tests are given.

SUBSTATIONS

Automatic. Automatic Substations (Sottostazioni automatiche), I. Prinetti. Elettrotecnica, vol. 7, no. 35, Dec. 15, 1920, pp. 722-625, 3 figs. European and American developments.

SUBWAYS

Paris. The Metropolitan Subway of Paris. (Le métropolitain de Paris), L. Biette. Genie Civil, vol. 78, no. 2003, Jan. 1, 1921, pp. 3-10, 15 figs. Extensions involving construction of tunnel under river and also tunnel parallel to docks for a certain length.

SUPERHEATERS

Marine. Steam Superheaters in Merchant Ships, H. B. Catley. Gen. Elec. Rev., vol. 24, no. 2, Feb. 1921, pp. 121-123, 5 figs. Classification into live-gas and waste-gas types. Location of superheater equipment.

The Sugden Uptake-Type of Superheater for Scotch Marine Boilers. Engineering, vol. 111, no. 2872, Jan. 14, 1921, pp. 37-40, 16 figs. Superheater is accommodated wholly in smokebox and Howden air heater is fitted at base of uptake.

T

TERMINALS, MARINE

Improvements. Marine Terminals and Port Facilities, Floyd T. Smith. Mar. Eng., vol. 26, no. 1, Jan. 1921, pp. 66-71, 5 figs. Survey of part developments, comtemplated.

TELEGRAPHY

Line Tension. How To Determine Tension in Telegraph and Telephone Lines. Ry. Signal Engr., vol. 14, no. 1, Jan. 1921, p. 37. Tension curves chart.

TELEPHONY

Aircraft. Aircraft Telephones, B. S. Cohen. Instn. Post Office Elec. Engrs., no. 77, Oct. 27, 1921, 39 pp., 25 figs. Developments of British Naval Air Service during war in communication by wire telephone between aircraft and ground.

Automatic. Interim British Standard Terms and Definitions for Use in Connection with Automatic Telephone Systems. British Eng. Standards Assn., no. 136, Dec. 1920, 7 pp. Terms on which agreement has been reached between British Eng. Standards Assn. and Am. Eng. Standards Committee.

Call Recording. Automatic Counting of Telephone Calls (Compteurs automatiques de conversations en téléphone manuelle), B. Gossot. Electricien, vol. 37, no. 1267, Jan. 1, 1921, pp. 1-7, 3 figs. Electric scheme for automatic counting of telephone calls.

Keeping Records of Telephone Calls (Téléphone et statistique), J. B. Pomey. Revue générale de l'Electricité, vol. 9. no. 5, Jan. 29, 1921, pp. 133-138, 3 figs. Empirical formula for determining probable number of calls to be received at central stations, developed from records at exchanges in Hamburg, and other German cities.

TERMINALS. RAILWAY

Freight-Handling Equipment. Better Freight Handling Methods by Mechanical Equipment, O. W. Stiles. Eng. News-Rec., vol. 86, no. 4. Jan. 27, 1921, pp. 151-153, 4 figs. Important economies effected by adapting existing terminal facilities to more efficient methods of operation.

Toronto. Mechanical and Electrical Equipment of the Toronto Union Station, Walter J. Armstrong. Jl. Eng. Inst. of Canada, vol. 4, no. 2, Feb. 1921, pp. 87-97, 7 figs. General survey of mechanical and electrical equipment for new Union Station, including heating and ventilation, lighting, elevators, power equipment fire-alarm systems, etc.

TESTING MACHINES

Developments. Recent Developments in Testing Machines, Thorsten Y. Olsen. Forging & Heat Treating, vol. 7, no. 1, Jan. 1921, pp. 66-69, 12 figs. Survey of developments during last 50 years.

Stop-Watch Uses. The Limitations of the Stop Watch as a Precision Instrument, A. L. Ellis. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 2, Feb. 1921, pp. 104-112. 22 figs. Accuracy to be expected in time measurements by stop watch in scientific and engineering testing.

Tenacity. The Tenacity of Materials as Basis for Calculating Steel Constructions, Especially Bridges (La ténacité des matériaux comme base des calculs de ponts et constructions métalliques en acier doux), N.-C. Kist. Vie technique & industrielle, vol. 2, no. 16, Jan. 1921, pp. 319-321, 1 fig. Theoretical study.

TRACTORS, FARM

American-Made. Detailed Technical Specifications of Gasoline Farm Tractors for 1921. Motor Age, vol. 39, no. 4, Jan. 27, 1921, pp. 106-109. Tabulated data on 76 different makes of American gasoline and kerosene arm tractors produced by manufacturers, with makes of principal parts, including engine, governor, lubricator, ignition system, air cleaner, gearset, clutch and axle.

TRANSPORTATION

Land, Air and Sea. A Comparison of the Cost of Transport and Ton-Miles by Land, Sea, and Air, Lord Montagu. Aeronautics, vol. 20, no. 380, Jan. 27, 1921, pp. 58-61. Lecture before Royal Aeronautical Soc.

TUBES

Bending of. A New Method of Bending Tubes. Machy. (Lond), vol. 17, no. 434, Jan. 20, 1921, pp. 490-491. Method consists of using either oil or water as means of obtaining pressure inside tube to prevent wrinkling, and pushing tube around bend instead of bending it to shape by means of punch or wheel.

V

VALVES

Hydraulic. A New Hydraulic Valve. Engr., vol. 131, no. 3395, Jan. 21, 1921, pp. 77, 4 figs. Miter seated type balanced hydraulically.

VIBRATIONS

Machinery. Vibration, Julius Frith. Practical Engr., vol. 63, no. 1770, Jan. 27, 1921, pp. 52-53. Laws governing vibrations of machinery and their application to particular cases, such as vibrations of crankshafts, flywheels and alternating-current generators. Paper read before Manchester Assn. of Engrs.

VOCATIONAL TRAINING

Disabled Soldiers. Rehabilitation of Our Disabled Soldiers, Sailors, and Marines and their Return to Civil Employment. Vocational Summary, vol. 3, no. 8, Dec. 1920, pp. 114-117. Training in business administration as conducted by Federal Board for Vocational Education.

W

WATER MAINS

Cleaning. The Effect of Different Waters on Mains, J. E. Gibson. Am. City, vol. 24, no. 2, Feb. 1921, pp. 159-162, 1 fig. Results of tests on water mains before and after cleaning.

WATER PURIFICATION

Sterilization. Relation of Raw Water to Endemic Typhoid Fever, Norman J. Howard. Can. Engrs., vol. 40, no. 3, Jan. 20, 1920, pp. 139-143, 2 figs. Incidence of typhoid fever in municipalities where water purification and sterilization plants are installed. Increased prevalence of disease in Toronto appears to follow periods of worst raw water although no connection can be traced. Mortality rate steadily declines despite enormous increase in b. coli content.

Sterilization of Water by Chlorine Gas, J. Stanley Arthur. Jl. Instn. Mech. Engrs., no. 9, Jan. 1921, pp. 1127-1153 and (discussion) pp. 1153-1198, 23 figs., partly on 5 supp. plates. Description of process and records of its operation specially at army stations.

Wells. Wells as a Source of Supply. Engineering, vol. 111, no. 2876, Feb. 11, 1921, pp. 161-164, 2 figs. Technical considerations involved in selection of site for construction of well.

WATER WORKS

Montreal. Combined Bridge and Control Dam Over Montreal Aqueduct. Contract Rec., vol. 35, no. 5, Feb. 2, 1921, pp. 103-104, 5 figs. Structure, known as Crawford Bridge, divided aqueduct into two parts and controls delivery of water to lower half by means of gate chamber at one abutment.

WEIRS

Parabolic. Parabolic Weirs, F. W. Greve. Proc. Am. Soc. Civil Engrs., vol. 47, no. 1, Jan. 1921, pp. 4-5. Tests on parabolic weirs in hydraulic laboratory of Purdue University. (Abstract.)

WELDING

Water Mains. 26-in. Welded Steel Main in Montana. Gas Age, vol. 47, no. 2, Jan. 25, 1921, pp. 53-55, 2 figs. Water pipe line including 26,000 ft. of welded large-size pipe.

See also Electric Welding.

WELDS

Failure of. The Reason Why Some Fusion Welds Fail, T. D. Sedwick. Ry. Mech. Engr., vol. 95, no. 2, Feb. 1921, pp. 114-118, 14 fig. Hardening effect of welding heat graphically demonstrated and effect of annealing shown. Paper read before Chicago Section, Am. Welding Soc.

Tests. Properties of Arc Metal and Arc Welds as Determined by Tests, O. H. Eschholz. Power vol. 53, no. 7, Feb. 15, 1921, pp. 250-255, 16 figs. Result of tests on electric-arc metallic-electrode welds. Tests included tensile, compression, cantilever, transverse, shear, impact, bending and hardness. Comparisons were made between properties of bulk and layer-deposited metal, Microscopic structure of welds. Fatigue resistance under repeated stresses. Magnetic properties.

WIND POWER

See Water Power, Wind Power vs.

WIND TUNNELS

Design. Design of Wind Tunnels and Wind Tunnel Propellers—II, F. H. Norton and Edward P. Warner. Nat. Advisory Committee for Aeronautics, no. 98, 1921, 10 pp., 20 figs. Study of directional variation in wind stream with a view to securing date for designing wind tunnels.

Manometers for. The Tilting Manometer, F. H. Norton and D. L. Bacon. Aerial Age, vol. 12, no. 23, Feb. 14, 1921, p. 585, 1 fig. Apparatus designed by technical staff on Nat. Committee for Aeronautics.

Recording Balances. Design of Recording Wind Tunnel Balances, F. H. Norton. Aerial Age, vol. 12, no. 20, Jan. 24, 1921, pp. 511-512, 9 figs. Design developed at Langley Memorial Aeronautical Laboratory of National Advisory Committee for Aeronautics. Works on parallelogram principle and is self-balancing but not recording.

WIRE MANUFACTURE

Hardening and Tempering Plant. Electric Wire Hardening and Tempering Plant. Engineering, vol. 111, no. 2873, Jan. 21, 1921, pp. 76 and 78. Continuous plant incorporating two processes, first heating and quenching to harden wire and re-heating and second quenching to give required temper.

WOMEN WORKERS

Accidents. A Study of Accidents Among Women in Industry, Nelle Swartz. Safety Eng., vol. 41, no. 1, Jan. 1921, pp. 19-22. Based on statistics gathered by New York State Industrial Commission.

Forewomen. The New Place of Women in Industry—V, Ida M. Tarbell. Indus. Management, vol. 61, no. 3, Feb. 1, 1921, pp. 135-137. Survey of advance of women workers into executive positions.

United States. Women in Industry. Monthly Labor Rev., vol. 12, no. 1, Jan. 1921, pp. 153-158. Results of inquiry finances by War Work Council of Young Women's Christian Assn., begun during war and carried down to 1919. It was desired to secure definite facts with regard to increase during war in number of women in industry, kinds of work in which they were employed and their success or failure in new lines of work.

WOODWORKING INDUSTRY

Engineering in. Engineering in the Woodworking Industries. B. A. Parks, H. S. Sackett, Lambert T. Ericson, Allan E. Hall, F. S. Park and I. M. Weber and D. W. Edwards. Mech. Eng., vol. 43, no. 2, Feb. 1921, pp. 85-101, 36 figs. Group of papers presented at annual meeting of Am. Soc. Mech. Engrs. dealing with furniture manufacture, freight-car construction, machining of railroad cross-ties, wood-block floors, wood preservation, and electrically driven sawmills.

Engineering Index

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A

AIRCRAFT

Maintenance. Ground Engineering, II. W. S. Outram. Aeronautics, vol. 20, no. 392, Feb. 10, 1921, pp. 96-98. British air navigation regulations for maintenance of aircraft at airdrome. Paper read before Royal Aeronautical Soc.

Plywood. *See Plywood.*

AIRSHIPS

Piloting. Airship Piloting. Aeronautical Jl., vol. 25, no. 122, Feb. 1921, pp. 47-71, 5 figs. Controlibility under severe weather conditions. Technique of piloting. Methods of aerial navigation.

See also Aircraft, Development during War; Hangars.

ALCOHOL

Industrial. Alcohol Production from Molasses George M. Appell. Chem. Age (N.Y.), vol. 92, no. 2, Feb. 1921, pp. 53-57, 1 fig. Diagram of classes of raw material and procedure of treatment for production of alcohol.

Industrial Alcohol Status in Canada. Can. Chem. & Metallurgy, vol. 5, no. 3, Mar. 1921, pp. 79-81. Legislation concerning manufacture of industrial alcohol.

Manufacture of Ethyl Alcohol from Wood Waste, E. C. Sherrard. Chem. Age (N.Y.), vol. 29, no. 2, Feb. 1921, pp. 76-79. Plant requirements.

ALLOYS

Standardization. Canadian Mechanical Standards. Paper, vol. 27, no. 26, Mar. 2, 1921, pp. 21-27 and 40, 12 figs. Report of Committee on Mechanical Standards of Canadian Paper & Pulp Assn. on standardization of metal alloys used in machinery employed for manufacture of paper. Investigations were conducted on acid-resisting bronze, properties of copper-tin-lead bronze, and antimonial lead, and also on a number of bearing metals.

ALUMINUM

Conductors. The Use of Aluminum Conductors on Transmission Lines, Theodore Varney. Elec. News, vol. 30, no. 5, Mar. 1, 1921, pp. 30-34, 6 figs. Relative merits of steel-cored aluminum and copper conductors on level and rough courses discussed before Toronto Section, Am. Inst. Elec. Engrs.

Ingots, Piping of. Causes of Piping in Aluminum Ingots, Junius David Edwards and Harold T. Gammon. Chem. & Metallurgical Eng., vol. 24, no. 8, Feb. 23, 1921, pp. 338-340, 12 figs. Measurements of piping and solidification shrinkage show that volume of pipe is dependent on four or even more definite factors, and that it is not specific property of metal or alloy.

Sheet. Stages in the Recrystallization of Aluminum Sheet on Heating: With a Note on the Birth of Crystals in Strained Metals and Alloys, H. C. H. Carpenter and Constance F. Elam. Advance Paper, no. 1, meeting of Inst. Metals, Mar. 9, 1921, 22 pp., 38 figs. Results of experiments.

ALUMINUM ALLOYS

Castings. Analyze Loss in Aluminum Shops—VI, Robt. J. Anderson. Foundry, vol. 49, no. 5, Mar. 1, 1921, pp. 188-191. Reasons for Losses in production of aluminum alloys and castings

Blowholes, Porosity, and Unsoundness in Aluminum Alloy Castings, Robert J. Anderson. Foundry Trade Jl., vol. 23, no. 237, Mar. 3, 1921, pp. 205-207, 8 figs. Data on six heats made on aluminum alloy, no 12 (92 per cent aluminum and 8 per cent copper), to determine temperature effects.

AMMONIA

Synthetic. Manufacture of Synthetic Ammonia at Oppau, Germany. Chem & Metallurgical Eng., vol. 24, nos. 8 and 9, Feb. 23 and Mar. 2, 1921, pp. 347-350, 7 figs, and 391-394, 8 figs., Feb. 23: Catalysis of nitrogen-hydrogen mixture. Description of catalyzing plant. Extraction of ammonia formed. Description of ammonia oxidation plant and its operation. Description of absorption of nitrous vapors plant and its operation. Mar. 2:

Run in manufacture of ammonium sulphate, ammonium chloride and ammonium nitrate. Coke plant, power stations and other supplementary plants required to make Oppau works complete entity. General organization. Translated from Technique Moderne.

AMMONIA COMPRESSORS

Mean Effective Pressures. Mean Effective Pressures John E. Starr. Refrigerating World, vol. 56, no. 3, Mar. 1921, pp. 11-12. Tables of multipliers of back pressure and temperature to obtain mean effective pressure and final gas temperatures in compressing gases.

APPRENTICES, TRAINING OF

Systems. Programs of Apprenticeship and Special Training in Representative Corporations—XI, J. V. L. Morris. Am. Mach., vol. 54, no. 12, Mar. 24, 1921, pp. 505-507, 3 figs. Practice of Goodyear Tire & Rubber Co., Akron, Ohio. Instruction of many kinds is provided by industrial university.

ARMATURES

Slot-Wound Coils. Longitudinal and Transverse Heat Flow in Slot-Wound Armature Coils, Carl J. Fechheimer. Jl. Am. Inst. Elec. Engrs., vol. 40, no 3, Mar. 1921, pp. 244-248. Formulas for calculating tempertures. (To be continued.)

AUTOMOBILE ENGINES

Diesel Type. Diesel Type of Engine for Motor Vehicle Work. Automotive Industries, vol. 44, no. 9, Mar. 3, 1921, pp. 501-509. 2 figs. Built by Deutsche Automobil Constructions Gesellschaft. Engine has two pistons in same cylinder and works on two-stroke cycle. Injection results from explosion in ignition chamber connected with combustion chamber by narrow passage.

Valves. The Graphical Analysis of Valve Gear. Automobile Engr., vol. 11, no. 147, Feb. 1921, pp. 66-67, 4 figs. Simplified method of investigation.

AUTOMOBILE FUELS

Alcohol. Possibilities of Alcohol for Fuel, A. H. Gilbert. Agricultural Eng., vol. 2, no. 1, Jan. 1921, pp. 5-6. Summary of research conducted by technical institutions and government agencies. Committee report presented at meeting of Am. Soc. of Agricultural Engrs.

See also Alcohol, Industrial.

Characteristics. The Character of Various Fuels for Internal Combustion Engines.—I. H. T. Tizard and D. R. Pye. Automobile Engr., vol. 11, no. 147, Feb. 1921, pp. 55-57. Theoretical investigation of influence of specific heat and dissociation of working fluid, made preliminary to experimental investigation conducted by H. R. Ricardo.

Tests. The Character of Various Fuels for Intern Combustion Engines.—II, H. T. Tizard and D. R. Pye. Automobile Engr., vol. 11, no. 148, Mar. 1921, pp. 98-101. 2 figs. Influence of specific heat and dissociation of working fluid. Calculation of maximum temperature allowing for dissociation.

The Influence of Various Fuels on the Performance of Internal Combustion Engines—II, H. R. Ricardo. Automobile Engr., vol. 11, no. 148, Mar. 1921, pp. 92-97, 7 figs. Experimental investigation into behavior of various automobile fuels. Graphs are given which show relation between air-cycle standard efficiency and compression ratio, also variation in mean effective pressure and thermal efficiency with different compression ratios for fuel detonating normally at compression of 5 to 1.

Vegetable Oils. Vegetable Oils as Fuel for Internal Combustion Engines. Engr., vol. 121, no. 3402, Mar. 11, 1921, pp. 255-256. Experiments on utilization of palm oil as engine fuel. Reports submitted to Assn. for the Improvement of Belgian Colonies.

See also Alcohol; Benzol; Gasoline.

AUTOMOBILES

Axles. Stub-Axle Stresses, J. L. Napier. Automobile Engr., vol. 11, no. 148, Mar. 1921, pp. 82-83, 2 figs. Study on stresses and their relation to sideship.

Design. Need for Greater Service Accessibility in Car Design, T. F. Cullen. Jl. Soc. Automotive Engrs., vol. 8, no. 3, Mar. 1921, pp. 257-264, 13 figs. Survey of automobiles in regard to accessibility of parts for repairs. Suggestions for increasing accessibility.

Why American, British and Continental Car Designs Differ, M. Olley. Automotive Industries, vol. 44, no. 10, Mar. 10, 1921, pp. 547-553. Writer discusses effect of customs, climate, road conditions, taxes, operating costs, size of industry, point of view and competition upon size, cost, appearance and design of passenger cars. Motoring here is characterized as transportation, while in Europe spirit of adventure still dominates. Considers American braking systems defective.

Radiators, Alcohol-Water Mixtures for. Report Giving Tables Showing the Freezing Points and Specific Gravity of Alcohol-Water Mixtures. Air Service Information Circular, vol. 12, no. 178, Jan. 20, 1921, 6 pp., 2 figs.

Transmissions. Developments in Transmission, S. Bramley-Moore. Automobile Engr., vol. 11, no. 147, Feb. 1921, pp. 70-75, 33 figs. Developments in clutch and gear-box design.

Gear Box v. Electrical Transmission. Autocar, vol. 46, no. 1319, Jan. 29, 1921, pp. 189-192, 11 figs. Relative merits of various transmission systems. It is claimed that electric transmission affords greater comfort and longer tire life. Curves are given showing comparative efficiencies of electrical and other methods of power transmission.

Wheel Hubs, Standardization. Move to Unify All interests in Hub Standardization Work, J. Edward Schipper. Automotive Industries, vol. 44, no. 11, Mar. 17, 1921, pp. 592-594, 1 fig. Standardization for ball-bearing front-axle hubs proposed by representatives of ball-bearing manufactures at joint meeting with Soc. Automotive Engrs.

AVIATION

Aerial Transportation. Aeroplane & Seaplane Transport Efficiency, H. White Smith. Aeronautics, vol. 20, no. 385, Mar. 3, 1921, pp. 151-152. Mobility, safety, reliability and economy of working of aerial transportation. (To be continued.) Paper read at Olympia Efficiency Exhibition.

The Cost of Aerial Transportation (Die Kosten der Luftreise), Alexander Baumann. Zeit, für Flugtechnik u. Motorluftschiffahrt, vol. 12, nos. 2 and 3, Jan. 31 and Feb. 15, 1921, pp. 17-20 and 33-35. Points out that if air traffic is to become firmly established, the costs must be reduced. This is possible in a slight degree through constructive methods referred to, but in a far greater degree through establishment of effective traffic routes, proper emergency landings, etc.

Civil. America's First Model Airway. Aviation, vol. 10, no. 9, Feb. 28, 1921, pp. 267-270, 1 fig. Proposed model airway from Washington, D. C., to Dayton, Ohio.

Status of Commercial Aircraft Shown by Company Development. Automotive Industries, vol. 44, no. 10, Mar. 10, 1921, pp. 559-561. List of flying companies operating in U. S. There are 88 companies operating about 400 aircraft units.

The Operation of Civil Aircraft in Relation to the Constructor, H. White-Smith. Flying, vol. 10, no. 2, Mar. 1921, pp. 47-59. Costs of operating commercial air services. Present position of seaplanes, flying boats and amphibians.

U. S. Commercial Aircraft Companies. Aviation, vol. 10, no. 10, Mar. 7, 1921, pp. 299-301. List of commercial aircraft operating companies in the United States and Canada, with account of air port facilities and aircraft owned and rates of service.

Commercial. Norway's Experience of Commercial Aviation. Flight, vol. 13, no. 6, Feb. 10, 1921, pp. 96-97, 3 figs. Records of air service in Norway.

Winged Transportation, Ladislas d'Orcy. Sci. Am., vol. 124, no. 9, Feb. 26, 1921, pp. 168-169, 3 figs. Survey of commercial air service in U. S., Europe and South America. List of world's air transport services.

Soaring Flight. Soaring Flight, M. A. S. Riach. Aeronautics, vol. 20, nos. 383-384, Feb. 17 and 21, 1921, pp. 117-118, 7 figs., and 132-134, 1 fig. Study of forces acting.

B

BEAMS

Reinforced-Concrete. Effect of Repeated Reversals of Stress on Double-Reinforced Concrete Beams, W. A. Slater, G. A. Smith and H. P. Mueller. Dept. of Commerce, Technologic Papers of Standards, no. 182, Dec. 20, 1920, 51 pp., 33 figs. Experiments. For all of beams tested failure was by tension in steel, all of failures occurring at sections where large cracks extended entirely across section of beam.

Graphical Method for Determining the Proportions of Reinforced Concrete T-Beams, G. Ivan Cope. Engineering, vol. 111, no. 2878, Feb. 25, 1921, pp. 215, 1 fig. Graph for determining size and quantity of steel necessary in T-beam for given bending moment, derived from formulas given in textbooks.

Shearing Stresses in Rectangular Reinforced Concrete Beams, Alfred Fyson. Concrete & Constructional Eng., vol. 16, no. 2, Feb. 1921, pp. 85-92 and (discussion) pp. 92-94, 1 fig. Computation of results and effects due to combined action of internal direct horizontal stresses at certain section and internal tangential stress intensities at any point in that section. (Concluded.)

Standard Sections. Eccentricity Factors for British Standard Sections, G. D. Balsille. Commonwealth Engr., vol. 8, no. 6, Jan. 1, 1921, pp. 176-180, 5 figs. Stresses in beams of standard sections.

BEARING METALS

See Alloys, Standardizion.

BEARINGS, BALL

Housings. Manufacturing a Ball Bearing Housing. Eng. Production, vol. 11, no. 19, Feb. 10, 1921, pp. 180-184, 10 figs. Jigs and tools for manufacturing small ball-bearing housings in quantities.

BENZOL

Specifications. New Purity Standard for Benzole. Autocar, vol. 45, no. 1323, Feb. 26, 1921, pp. 369. Specifications adopted by British Eng. Standards Assn.

BLAST-FURNACE GAS

Cleaning Process. Recovery Process for Flue Dust, George B. Cramp. Blast Furnace & Steel Plant, vol. 9, no. 3, Mar. 1921, pp. 198-202, 1 fig. Claims that first cost of direct-recovery plant is smaller than that of any other process, and also that operating expenses are very low.

Gas Balances. The Relative Distribution of Blast-Furnace Gases as Fundamental Basis of the Heat Economics of Mixed Steam and Gas Power Installations (Die bilanzmissige Verteilung der Gichtgase als Grundlage der Wärmewirtschaft gemischter Werke), G. Schulz. Stahl u. Eisen, vol. 41, no. 5, Feb. 3, 1921, pp. 145-149 and (discussion) pp. 149-150, 5 figs. Results of work of a special commission of engineers in drawing up a gas balance for blast-furnace gases.

Measurement. Measurement of Blast-Furnace Gas, D. L. Ward. Min. & Metallurgy, no. 170, Feb. 1921, pp. 33-34, 1 fig. Study to determine how much surplus power could be produced through proper utilization of entire gas flow from two furnace stacks at Federal Furnace Plant, South Chicago, Ill., Method of measuring flow of gas.

BLAST FURNACES

Air Preheaters. Air Preheaters (Kritische Bemerkungen über Winderhitzer), Emil Wurmbach. Stahl u. Eisen, vol. 41, no. 3, Jan. 20, 1921, pp. 74-76, 1 fig. Critical discussion of heat transmission from the heating gas to the bricks and from these to the blast.

BOILER FEEDWATER

Treatment. Control of Salt Content in Boiler Water, Claude C. Brown. Power Plant Eng., vol. 25, no. 5, Mar. 1, 1921, pp. 264-266, 4 figs. Chart showing amount of blowdown necessary for varying degrees of salinity and varying boiler ratings.

Degassing and Purification of Boiler Feed Water, Paul Kestner. Engineering, vol. 111, no. 2880, Mar. 11, 1921, pp. 291. Process of continuous blowing down used in conjunction with hot purification. (Abstract.) Paper read before joint meeting of Instn. Mech. Engrs. and Soc. Chem. Industry.

Kestner Apparatus for Removal of Gases from Feedwater (L'appareil dégazeur Kestner), M. Perdrizet. Revue générale de l'Electricité, vol. 9, no. 6, Feb. 5, 1921, pp. 185-187, 4 figs. Mechanical and chemical degasification.

BOILER INSPECTION

Legislation. Uniform Boiler Inspection Laws, C. O. Meyers. Power Plant Eng., vol. 25, no. 5, Mar. 1, 1921, pp. 288-289. Advantages sought and difficulties encountered in enforcement. Experience in Ohio.

BOILER OPERATION

Gas-Fired Boilers. Investigation of Gas-Fired Steam Plant, R. L. Ellis. Power, vol. 53, no. 12, Mar. 22, 1921, pp. 472-473, 1 fig. Study in operating efficiencies and control methods in 48,000 sq. ft. boiler plant using coke oven gas as fuel. Results show CO_2 flue-gas content reliable efficiency indicator, and excess air not requisite for practically complete combustion.

Instruments. A Continuous Densimeter for Boilers, Engr., vol. 131, no. 3398, Feb. 11, 1921, pp. 157-158. Patented apparatus for ascertaining density of boiler water. Principle of operation is that column of distilled water is balanced against column of water contained in boiler.

BOILERS

Baffling. Recent Practice in Baffling Boilers, Kingsley L. Martin. Power Plant Eng., vol. 25, no. 6, Mar. 15, 1921, pp. 135-137, 4 figs. Typical installations of baffles.

Capacity Limitations. Ultimate Boiler Capacity Limited by Stoker Conditions, Joseph Harrington. Elec. Rev. (Chicago), vol. 78, no. 12, Mar. 19, 1921, pp. 451-453, 2 figs. Size and distribution of air openings through grates. Forced draft required to overcome resistance in fuel bed. Formation of clinker influenced by character of coal and other factors.

BRASS

Cobalt. Cobalt Brasses, Leon Guillet. Chem. & Metallurgical Eng., vol. 24, no. 10, Mar. 9, 1921, pp. 439-443, 11 figs. Experimental comparison of role of cobalt with that of nickel in copper-zinc alloys.

Season Cracking. The Season-Cracking of Brass and Other Copper Alloys, H. Moore, S. Beckinsale and Clarice E. Mallinson. Advance Paper, no. 5, meeting of Inst. Metals, Mar. 10, 1921, 91 pp., 23 figs. Experimental investigation of causes of season-cracking at Research Dept., Woolwich, England.

BRIDGE DESIGNS

Column Formulas. A Review of Column Formulas for Bridge Design. Eng. News-Rec., vol. 86, no. 10, Mar. 10, 1921, pp. 431-433, 10 figs. Exclusive use of Rankine formula is advocated. Curves of tests to failure are shown which would establish its correctness and indicate that other formulas are merely approximate.

BRIDGE ERECTION

Southwark Bridge, London. The New Southwark Bridge. Engineering, vol. 111, no. 2880, Mar. 11, 1921, pp. 281-283 and 294, 14 figs., partly on supp. plate. Features of falsework which were necessary to provide highway for foot passenger traffic during period covered by demolition of old bridge and building of new.

BRIDGES, RAILWAY

Wooden. Report of Committee VII—On Wooden Bridges and Trestles. Bul. Am. Ry. Eng. Assn., vol. 22, no. 233, Jan. 1921, pp. 481-512. General specifications and classification and grading rules for timber and lumber for railroad purposes. Specifications for timber to be treated with preservative substance.

BRIDGES, STEEL

Paint Tests. P. & L. E. Conducts an Extended Paint Test. Ry. Age, vol. 70, no. 10, Mar. 11, 1921, pp. 561-562, 7 figs. Steel-bridge coatings supplied by 11 manufacturers subjected to severe service for period of six years.

BRUSHES

Carbon. The Proper Selection of Carbon Brushes, L. A. Heath. Assn. Iron & Steel Elec. Engrs., vol. 3, no. 3, Mar. 1921, pp. 52-56 and (discussion) pp. 56-67. Sphere and usefulness for each of four groups of brushes: carbon, graphite, electrographitic and copper graphite.

BUILDING CONSTRUCTION

Metal Lath Application. The Correct Application of Metal Lath to Avoid Plaster Cracks. Am. Architect, vol. 119, no. 2358, Mar. 2, 1921, pp. 246-250, 12 figs. Results of tests recently conducted at Armour Inst., showing best forms of applications.

Reinforced Concrete. The Contractor's Plant in Reinforced Concrete Building Construction. Concrete, vol. 18, no. 3, Mar. 1921, pp. 101-104, 6 figs. Recommendations in regard to layout of plant. Report of Committee on Contractors' Plant in Reinforced Concrete Building Construction, of Am. Concrete Inst.

C

CABLES, ELECTRIC

Working Voltages. Maximum Alloable Working Voltages in Cables, Charles W. Davis and Donald M. Simons. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 1, Jan. 1921, pp. 12-22, 5 figs. Tables of maximum voltage stress in various types of cables.

CAISSONS

Pneumatic. Modern Pneumatic Caisson Practice, Frank W. Skinner. Compressed Air Mag., vol. 26, no. 3, Mar. 1921, pp. 9991-10005, 11 figs. Typical instances of application.

CAMS

Design. Harmonic Cams With Flat Followers, R. J. Cousins. Automobile Engr., vol. 11, no. 147, Feb. 1921, p. 42, 3 figs. Principles involved in design of cam acting directly on flat-ended tappet.

CAR CONSTRUCTION

Support on Truck. New Type of Support for Railway Cars (Nouveau type de suspension pour voiture à bogies). Génie Civil, vol. 78, no. 8, Feb. 19, 1921, pp. 178-179, 1 fig. Pendulum support, From Revue générale des Chemins de fer.

CAR COUPLERS

Failure. Causes of the Rupture of Railway Car Couplings (Les causes des ruptures d'attelages de chemins de fer). Génie Civil, vol. 78, no. 10, Mar. 5, 1921, pp. 212-215, 14 figs. Interpretation of photomicrographs of ruptured specimens. Failure is attributed to carelessness in forming and insufficiency of elastic resistance in traction springs.

CAR WHEELS

Chilled Cast-Iron. Instruction for Grinding Chilled Cast Iron Car Wheels, Ry. Mech. Engr., vol. 95, no. 3, Mar. 1921, pp. 181-183. Practice of Atchison, Topeka and Santa Fe Railroad. Tables giving grinding diameters for slid flat wheels.

CARS

Container. Container Car in Express Service on N. Y. C. Lines. Ry. Mech. Engr., vol. 95, no. 3, Mar. 1921, pp. 171-172, 4 figs. Experimental container car operated by Am. Ry. Express between New York and Chicago. Car consists of nine separate containers or steel boxes firmly secured on car to prevent shifting during train movement. Each container is removable so that it may be transported by motor truck between stores or factories and railroad.

Diesel-Electric. The Diesel Engine in Railroad Service. Ry. Mech. Engr., vol. 95, no. 3, Mar. 1921, pp. 156-159. Diesel-electric cars on Swedish railways.

CARS, FREIGHT

Cost of Reproduction. The Cost of Reproduction New of Steel Freight Cars. Ry. Age, vol. 70, no. 10, Mar. 11, 1921, pp. 553-556, 4 figs. Report issued by Equipment Committee of Presidents' Conference Committee on Federal Valuation. Gondola, hopper, coke and tank cars are taken up. Price is based on weight of so-called base car to which price are added certain net figures to cover cost of specialties.

Six-Wheel Truck. The Lamont Six-Wheel Truck for Freight Cars. Ry. Age, vol. 70, no. 11, Mar. 18, 1921, pp. 729-731, 4 figs. Side frames are continuous over three journals. Special design of equalizing system used.

CASE-HARDENING

Cyanide Action. True Action of Cyanide in Case-Hardening Steel, G. R. Brophy and S. B. Leiter. Trans. Am. Soc. for Steel Treating, vol. 1, no. 6, Mar. 1921, pp. 330-338, 13 figs. Interpretation of photomicrographs.

Cyanogen Case Carburizing. A New Method of Case-Hardening Steel, W. J. Merten. Can. Machy., vol. 25, no. 9, Mar. 3, 1921, pp. 77-80, 1 fig. Steel and iron alloy articles are case-hardened in stream of cyanogen gas evolved from container filled with an alkali cyanide salt, heated by electrical energy or other means to accomplish vaporization of salt.

Ingots During Casting. The Composite Process of Carburisation of Steel During Casting, Major Waddington. Iron & Coal Trades Rev., vol. 102, no. 2766, Mar. 4, 1921, p. 311, 3 figs. Ingot mold was lined on one side only with amorphous carbon blocks. Rail was subsequently rolled from ingot, running surface of rail corresponding to side with greater carbon content.

Tests. A Research in Case Carbonizing, G. S. McFarland. Trans. Am. Soc. for Steel Treating, vol. 1, no. 6, Mar. 1921, pp. 297-305, 24 figs. Comparison of 5 per cent nickel steel, carbon steel and chrome-vanadium steel when used for case carbonizing. Nickel steel proved superior to other two.

CAST IRON

Tests. Mechanical Tests for Cast Iron—Part I, F. G. Cook. Foundry Trade Jl., vol. 23, no. 234, Feb. 10, 1921, pp. 132-134. Survey of tests usually required by engineers' specifications and of those adopted as guide to efficient working in foundry. (To be continued.) Paper read before London Branch, Instn. British Foundrymen.

CEMENT

Slag. Slag Cement (Béton de scories), B. Jeanneret, Bulletin technique de la suisse romande, vol. 47, no. 3, Feb. 5, 1921, pp. 27-29, 2 figs. Tests of strength of blast-furnace slag cement.

CENTRAL STATIONS

Economical Advantages. Progress of the Superpower Survey. Elec. World, vol. 77, no. 10, Mar. 5, 1921, pp. 539-540. Annual saving to railroads of $90,000,000 through electrification and of 4,000,000 tons of coal by the utilities, together with legislative and financial program, stated in superpower survey being made under auspices of United States Dept. of the Interior.

Steam Hydraulic Relay Service. Steam Stations for Hydraulic Relay Service, E. B. Powell. Power Plant Eng., vol. 25, no. 6, Mar. 15, 1921, pp. 310-315, 6 figs. Consideration of design factors of various types of supplementary power schemes available. Paper presented at joint meeting of Boston Sections of Am. Soc. Mech. Engrs., Am. Inst. Elec. Engrs., and Boston Soc. Civil Engrs.

Superpower. Industries and Superpower, Harold Goodwin, Jr. Jl. Engrs. Club of Phila., vol. 38, no. 194, Feb. 1921, pp. 63-68, 5 figs. Survey of power consumption in northeastern part of U. S., including greater part of New England and New York, New Jersey and Delaware, and part of Pennsylvania and Virginia. Figures of 1914 census indicate that there are about 10,000,000 hp. in zone, and that coal consumption amounts to 60,000,000 tons per annum. Advantages of centralizing power generation are pointed out.

CEMENT GUN

Slabs, Strength of. Strength of Reinforced Gunite Slabs, George E. Strehan. Concrete, vol. 18, no. 3, Mar. 1921, pp. 132-134, 2 figs. Deflection curves for gunite and concrete slabs. Table of safe load.

CIRCUIT BREAKERS

Oil. Present-Day Practice Limitations of Oil Circuit Breakers, H. R. Woodrow. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 3, Mar. 1921, pp. 198-200. From replied received to questionnaire sent out to larger operating companies. Report of subcommittee on oil circuit breakers and switches of protective devices committee.

CLOTHES

Mechanical Uses. Cloths for Mechanical Uses, James W. Cox, Jr. Mech. Eng., vol. 43, no. 3, Mar. 1921, pp. 177-180 and 220. Classification of cloths, enumeration of industries in which they are used, and exposition of their specific uses as absorptives, and for belting, conveying, filtering, etc.

COAL

Briquetting. Briquetted Coal for Household Fuel, J. H. Kennedy. Jl. Am. Soc. Heat & Vent. Engrs., vol. 27, no. 2, Mar. 1921, pp. 101-106. European practice.

COAL DUST

Precautions Against. Precautions Against Coal Dust. Iron & Coal Trades Rev., vol. 102, no. 2765, Feb. 25, 1921, p. 283. Orders issued by British Secretary of Mines regarding tests to be adopted in connection with precautions against coal dust.

COAL WASHING

Froth Flotation. Purification of Coal by Froth Flotation. Colliery Guardian, vol. 121, no. 3136, Feb. 4, 1921, pp. 337. Process for recuperating coal dust from refractory fines.

COKE OVENS

Linings. Silica Bricks for Coke Ovens. Iron & Coal Trades Rev., vol. 111, no. 2764, Feb. 18, 1921, pp. 232-233. Comparison of silica and firebrick linings.

COMBUSTION

Control. Control of Combustion (La comburimétrie industrielle), A. Grebel. Génie Civil, vol. 78, nos. 4 and 5, Jan. 22 and 29, 1921, pp. 78-82, 4 figs., and 103-104, 3 figs., Jan. 22. Grebel-Velter apparatus for controlling combustion, Jan. 29: The Frère air recorder.

CONCRETE

Proportioning Aggregates. New Methods of Proportioning Concrete. Can. Engr., vol. 40, no. 9, Mar. 3, 1921, pp. 263-265. Specifications adopted by Hydroelectric Power Commission of Ontario.

Use in Sea Water. Report of Committee VIII—On Masonry. Bul. Am. Ry. Eng. Assn., vol. 22, no. 233, Jan. 1921, pp. 543-564, 11 figs. Disintegration of concrete and corrosion of reinforcing materials in connection with use of concrete in sea water. Effect upon strength and durability of concrete not having sufficiency of moisture present throughout period of hardening.

Waterproof. How Concrete is Made Waterproof, James Scott. Contract Rec., vol. 35, no. 8, Feb. 23, 1921, pp. 198-199, 4 figs. Analysis of microscopical actions and chemical modifications taking place on addition of "pudlo" to concrete.

Wear Under Water. Water Content Affects Wear of Concrete Tests Pieces, Dan Patch. Eng. News-Rec., vol. 86, no. 9, Mar. 3, 1921, pp. 373, 1 fig. Report of behavior of test pieces placed in Boston harbor in 1909.

CONCRETE CONSTRUCTION, REINFORCED

Calculation. Short Cuts for Calculating and Extimating Reinforced Concrete, Milo S. Farwell. Am. Architect, vol. 119, no. 2358, Mar. 2, 1921, pp. 251-254, 14 figs. Graphs for computing costs.

Forms. Concrete Forms and Surface Treatment, T. Trueman Black. Can. Engr., vol. 40, no. 8, Feb. 24, 1921, pp. 239-243, 3 figs. Economical comparison of steel and wooden forms. Paper read before Toronto branch, Eng. Inst. of Canada.

Railways. On the Question of Reinforced Concrete, Marcel Castiau. Bul. of the Int. Ry. Assn., vol. 3, no. 2, Feb. 1921, pp. 99-195, 81 figs. Survey of developments in construction of reinforced concrete structures in European railways. Typical designs of terminals, bridges, trestles and ties.

CONDENSERS, STEAM

Cooling of Water in Canal. The Cooling of Water in a Canal, L. C. Kemp. English Elec. Jl., vol. 1, no. 5, Jan. 1921, pp. 210-222, 8 figs. Experiments carried out at Lero Road Power Station, Leicester, England. Situated on banks of canal upon which it relies entirely for cooling of circulating water for condensers.

Tests. Test Results of a 50,000 Square-Foot Surface Condenser. Power, vol. 53, no. 11, Mar. 15, 1921, pp. 414-416, 4 figs.

COPPER ALLOYS

Copper-Tin. The Constitution of the Alloys of Copper with Tin. Parts III and IV, John L. Haughton. Advance Paper no. 6, meeting of Inst. Metals, Mar. 10, 1921, 22 pp., 23 figs. Experimental study of transformations other than formation of eutectic occurring below 250 deg. cent.

Plastic Deformation. Plastic Deformation of Some Copper Alloys at Elevated Temperatures, C. A. Edwards and A. M. Herbert. Advance Paper, no. 3, meeting of Inst. Metals, Mar. 9, 1921, 25 pp., 11 figs. Experimental investigation.

CORROSION

Browning Rust-Prevention Process. Rust Prevention by Browning Process, W. C. Marshall. Automotive Industries, vol. 44, no. 10, Mar. 10, 1921, pp. 556-558. Specifications for preparation of solutions and methods of application.

Steel Containing Copper. Corrosion Tests with Steel Plates Containing Copper (Rostversuche mit kupferhaltigen Eisenblechen), O. Bauer. Stahl u. Eisen, vol. 41, nos. 2 and 3, Jan. 13 and 20, 1921, pp. 37-45 and 76-83, 11 figs. Account of tests carried out in pure atmosphere (on roof of material-testing station in Berlin-Dahlem), at the seashore (North Sea), and in industrial district in Westphalia. It is shown that a small addition of copper to iron is a good protection against unfavorable effect of sulphuric acid; phosphorus greatly increases the susceptibility of iron to sulphuric acid and addition of copper neutralizes to certain extent the unfavorable action of phosphorus.

COST ACCOUNTING

Indirect Costs. Aligning the Power Plant with the Cost Department, Malcolm C. W. Tomlinson. Indus. Management, vol. 61, no. 5, Mar. 1, 1921, pp. 171-172. Suggestions in regard to reducing power, light and heat costs.

Relation to Production. Costing Methods and Increased Productivity, H. W. Allingham. Eng. & Indus. Management, vol. 5, no. 7, Feb. 17, 1921, pp. 196-198. Discussion held under auspices of British Instn. of Cost and Works Accountants.

CRANE HOOKS

Stresses in. The Strength of a Hook or "Clivvy," Charles D. Mottram. Colliery Guardian, vol. 121, no. 3137, Feb. 11, 1921, pp. 411-412, 4 figs. Measurement of stresses in crane hook where maximum load was 5 tons.

CRANES

Shipyards. Shipyard Cranes, H. H. Vernon. Gen. Elec. Rev., vol. 24, no. 3, Mar. 1921, pp. 230-233, 11 figs. Typical installations of electrically-operated cranes at American shipyards.

CRANKSHAFTS

Manufacture. Crankshaft Turning Practice, J. V. Hunter. Am. Mach., vol. 54, no. 11, Mar. 17, 1921, pp. 456-458, 7 figs. Cheeks, pins and bearings turned in special lathes. Shafts driven from both ends by pot-chucks. Special tooling methods employed.

Quantity Making of Crankshafts. Abrasive Industry, vol. 2, no. 2, Feb. 1921, pp. 49-52, 6 figs. Methods at plant of Automobile Crank Shaft Corp., Detroit.

CYLINDERS

Boring. Methods in a Tractor Engine Plant Machy. (N.Y.), vol. 27, no. 7, Mar. 1921, pp. 641-644, 8 figs. Method of machining cylinder liners on rotary type of boring machine at plant of Avery Co., Milwaukee.

D

DAMS

Hydraulic Fill. Completing Germantown Dam. Public Works, vol. 50, no. 9, Feb. 26, 1921, pp. 183-187. 5 figs. Top of 798,000-yd. hydraulic fill 110 ft. high placed by special method. Outlet conduits reduced to permanent cross sections. Spilway and paving finished and 20,000 yd. of concrete placed in appurtenances.

Method of Topping Out Germantown Hydraulic Fill Dam. Eng. & Contracting, vol. 55, no. 10, Mar. 9, 1921, pp. 224-225, 3 figs. Upper layers of dam were constructed from mixture of all borrow pit materials deposited in narrow centre pool by hydraulic method.

DIES

Curling. Curling Die Construction, J. Bingham. Machy. (N. Y.), vol. 27, no. 7, Mar. 1921, pp. 651-652, 4 figs. Punch and die designed to flange out bottom of drinking cup shell and to curl top.

Drop-Forging. Life of Drop Forge Dies, J. S. Clover. Forging & Heat Treating, vol. 7, no. 2, Feb. 1921, pp. 120-123, 1 fig. Suggests general systematic handling scheme.

Electrical Fixtures. Dies for Electrical Terminals and Connectors, John A. Honegger. Machy. (N. Y.), vol. 27, no. 7, Mar. 1921, pp. 626-629, 10 figs. Dies employed in manufacture of connectors or terminals for wires of electric lighting units.

Manufacture. Dies for Hemispherical, Conical and Other Flanged Shells, J. Bingham. Machy. (N. Y.), vol. 27, no. 6, Feb. 1921, pp. 546-548, 8 figs. Details of manufacture and methods of operation.

Piercing. The Design and Construction of Press Tools—II. Eng. Production, vol. 2, no. 20, Feb. 17, 1921, pp. 212-214, 7 figs. Types of piercing dies.

DIESEL ENGINES

Burmeister-Wain. First Details of New Burmeister and Wain Engine for Single Screw Motorships. Motorship, vol. 6, no. 3, March 1921, p. 216, 2 figs. Long-stroke Diesel engines with piston removable from below.

Canadian-Built. The First True Diesel Made in Canada. Power House, vol. 14, no. 5, Mar. 5, 1921, pp. 21-24, 8 figs. Also Can. Machy., vol. 25, no. 11, Mar. 17, 1921, pp. 41-44, 8 figs. Description of 100-b hp. four-cylinder Diesel engine built by Dominion Steel Products Co.

Double-Acting. The Double-Acting Diesel Engine, A. P. Chalkley. Pacific Mar. Rev., vol. 18, no. 3, Mar. 1921, pp. 149-150, 4 figs. Installation in motorship "Assyrian."

Installations in United States. The Diesel-Engine Industry, L. H. Morrison. Power, vol. 53, no. 9, Mar. 1, 1921, pp. 336-340, 6 figs. Table giving Diesel-engine installations in U. S. by industries, also statistics on installations by states.

Marine. Cooling of Cylinders and Pistons of Marine Diesel Engines, Louis R. Ford. Power, vol. 53, no. 11, Mar. 15, 1921, pp. 426-429, 3 figs. Study of causes of typical piston failures.

Diesel Engine Crankshafts, Joseph Hecking. Mar. Eng., vol. 26, no. 2, Feb. 1921, pp. 147-153, 9 figs. Investigation made in connection with classification rules of Am. Bur. of Shipping.

Standardization. Standardized Diesel Engines, H. R. Setz. Mar. Eng., vol. 26, no. 3, Mar. 1921, pp. 222-228, 6 figs. Suggestions in regard to standardization of four-cycle type. (To be continued.)

DRAWING

Machine Parts. The Relative Economic Value of Drawn Machine Parts and Those Machined from Solid Materials (Wirtschaftlicher Vergleich zwischen gezogenen und aus Vollmaterial hergestellten Maschinenteilen), K. Brendle. Betrieb, vol. 3, no. 8, Jan. 25, 1921, pp. 207-210, 8 figs. A typical example, with preliminary calculations and comparative tables, are given to show that parts machined from solid material could often be produced at much lower cost through drawing.

DRILL CHUCKS

Interchangeable Manufacture. Application of Interchangeability to Drill Chuck Manufacture, Fred. R. Daniels. Machy. (N. Y.), vol. 27, nos. 6 and 7, Feb. and Mar. 1921, pp. 509-515, 9 figs., and 674-679, 18 figs. Tooling and gaging equipment used by Marvin & Casler Co., Canastota, N. Y., in manufacturing Casler twin-screw drill chuck.

DRILLING MACHINES

Multiple. A Machine for Multiple Drilling and Tapping. Automotive Industries, vol. 44, no. 11, Mar. 17, 1921, pp. 611. Employs automobile type friction clutch in main driving pulley to enable power to be shut off when change in direction of rotation of spindles is made.

DRILLS

Pneumatic. Four-Cylinder Pneumatic Drill. Engineering, vol. 111, no. 2879, Mar. 4, 1921, p. 253, 4 figs. Light design with aluminum castings.

DUST

Determination in Air. Efficiency of the Sugar-Tube Method for Determining Dust in Air, A. C. Fieldner, S. H. Katz and E. S. Longfellow. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 27, no. 2, Mar. 1921, pp. 119-123, 2 figs. Experiments at U. S. Bur. of Mines.

Removal from Grinding Plants. Investigation of Dust in the Air of Granite-Working Plants, S. H. Katz. Reports of Investigations, Bur. of Mines, Dept. of Interior, Feb. 1921, serial no. 2213, 2 pp. Methods used by U. S. Bureau of Mines in co-operation with Granite Manufacturers' Assn. for determining dustiness in granite-working plants.

Reducing Grinding Hazards. Abrasive Industry, vol. 2, no. 2, Feb. 1921, pp. 37-41, 9 figs. Tests conducted in various manufacturing plants by the U. S. Public Health Service revealed that grinders' consumption is prevalent to a great extent in wet grinding plants. Methods of disposing of dust are surveyed.

E

EDUCATION, ENGINEERING

Industries and. What Our Engineering Colleges Owe Our Industries, Robertson Matthews. Indus. Management, vol. 61, no. 5, Mar. 1, 1921, pp. 155-158. More character-building, even at expense of specialized training, urged to supply industry with leaders who have human touch.

ELECTRIC CONDUCTORS

See Aluminum, Electric Conductors.

ELECTRIC DRIVE

Machine Tools. Standardizing Motors for Tools, H. R. Weedon. Iron Trade Rev., vol. 68, no. 8, Feb. 24, 1921, pp. 555-557, 3 figs. Urges co-operation between motor manufacturers and machine-tool makers in securing possible application of general types of electric motors to machine tools. Paper read before Nat. Machine Tool Builders' Assn.

Mounting Motors. Mounting Motors to Afford Convenience, J. S. Thomas. Elec. World, vol. 77, no. 11, Mar. 12, 1921, pp. 594-597, 3 figs. Methods of mounting motors to increase free space in shop. Typical installations.

Paper Machines. Automatic Speed Control for Sectional Paper Machine Drive, Stephen A. Staege. Elec. Jl., vol. 18, no. 3, Mar. 1921, pp. 78-82, 5 figs. Schematic plan and wiring diagram of Westinghouse system of sectional individual motor drive.

Rubber Industry. The Application of Electric Power to the Rubber Industry. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 1, Jan. 1921, pp. 35-47. Possibilities of electric power. Application of 40-degree and 50-degree motors. Steam versus electrically heated drying ovens. Steam versus electric-heat treatment of vegetable compounds.

Textile Mills. Continental Practice in the Electrical Driving of Textile Factories, W. Dundas Fox. Elecn., vol. 84, no. 2229, Feb. 4, 1921, pp. 165-168, 6 figs. Experiments with electric drive at works of Max Schorch & Co., Germany.

Modern Methods of Driving Machines in Jute Manufacture, T. Woodhouse and P. Kilgour. Elecn., vol. 84, no. 2229, Feb. 4, 1921, pp. 159-165, 9 figs. Advantages of electric drive.

Some Considerations in the Application of Electricity to Textile Mills, J. T. Randles. Elecn., vol. 84, no. 2229, Feb. 4, 1921, pp. 153-156, 6 figs. Estimates of power requirements.

The Individual Electric Drive, Frank Nasmith. Elecn., vol. 84, no. 2229, Feb. 4, 1921, pp. 157-159, 6 figs. Developments in application of electric drive in textile mills in U. S.

The Individual Gear Drive for Heavy Looms, G. F. Sills. Elecn., vol. 84, no. 2229, Feb. 4, 1921, pp. 150-153, 8 figs. Typical installations.

The Use of Gears and High Speed Motors in Textile Mills, George S. Sharman. Elecn., vol. 84, no. 2229, Feb. 4, 1921, pp. 168-171, 6 figs. Practice in English mills.

Tinplate Mills. Electricity in the Tinplate Industry, L. Rothera. English Elec. Jl., vol. 1, no. 5, Jan. 1921, pp. 190-198, 10 figs. Typical installations and records of their operation.

ELECTRIC FURNACES

Iron Founding. Cost of Synthetic Gray Iron Low, R. C. Gosrow. Foundry, vol. 49, no. 6, Mar. 15, 1921, pp. 242-243. Tables giving cost of electrically melted gray iron produced from iron and from steel.

Electric Furnace Improves Gray Iron, Richard Moldenke. Foundry, vol. 49, no. 6, Mar. 15, 1921, pp. 216-218. Sulphur lowered by treating cupola metal or melting direct on basic bottom. Paper read before Am. Inst. Min. & Metallurgical Engrs.

The Electric Furnace in the Iron Foundry, Richard Moldenke. Min. & Metallurgy, no. 170, Feb. 1921, p. 32. Advantages of basic-hearth electric Furnace. (Abstract.)

Steel Manufacture. Electric Furnace for High-Speed Steel. Iron Age, vol. 107, no. 11, Mar. 17, 1921, pp. 691-692. Newkirk furnace of two tons capacity, with graphite electrodes and specially constructed bottom electrode.

ELECTRIC GENERATORS, D. C.

Parallel Operation. Parallel Operation of Compound Generators, A. M. Bennett. Power, vol. 53, no. 12, Mar. 22, 1921, pp. 459-462, 7 figs. Characteristics of compound generators. Arrangement of switches and adjustment of voltage. Relation of equalizer to armature polarity. Three-wire generators in parallel. Three-wire and two-wire machines in parallel.

ELECTRIC MOTORS

Inspection. Inspection and Care of Electric Motors, H. M. Phillips. Power, vol. 53, no. 9, Mar. 1, 1921, pp. 341-344, 3 figs. Suggested forms for making reports.

ELECTRIC MOTORS, A. C.

Induction. Short-Circuit Current of Induction Motors and Generators, R. E. Doherty and E. T. Williamson. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 1, Jan. 1921, pp. 1-11, 11 figs. Theoretical considerations and experimental data are given to show that there is in induction generator, just as in synchronous machine, serious initial rush of current which is limited only by leakage reactance of machine.

Phase Compensation. Phase Compensation With Special Reference to Polyphase Motors, Val A. Fynn. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 1, Jan. 1921, pp. 48-64, 49 figs. Controlling phase difference in single-phase motor with shunt characteristics by changing phase of exciting E.M.F.

ELECTRIC RAILWAYS

Operation. The Use of Helpers in Electric Train Operation, W. F. H. Hamilton. Ry. Age, vol. 70, no. 8, Feb. 25, 1921, pp. 455-458, 2 figs. Speed-tractive efforts curves on resistance for electric freight locomotives used on Chicago, Milwaukee & St. Paul.

ELECTRIC TRANSMISSION LINES

Non-Uniform. Propagation of Periodic Currents Over Non-Uniform Lines, John R. Carson. Elecn., vol. 86, no. 2233, Mar. 4, 1921, pp. 272-273. Integration of differential equations of transmission line for general case where line parameters are arbitrary functions of distance, as measured along line.

ELECTRIC WELDING, ARC

Foundry Equipment. Arc Welding Equipment in the Foundry, W. W. Reddie. Elec. Jl., vol. 18, no. 3, Mar. 1921, pp. 96-99, 10 figs. Equipment for cutting heavy risers and sink heads from steel or iron castings or for filling blow holes of castings.

Metal Deposition. Phenomena of Arc Welding, O. H. Eschholz. Thirty-ninth Gen. Meeting, Am. Electrochemical Soc., April 21-23, 1921, advance paper no. 8, pp. 59-71, 16 figs. Discussion of metal deposition, fusion and arc stability during electric welding.

Studding. Studding for Arc Welding, C. J. Holslag. Welding Engr., vol. 6, no. 2, Feb. 1921, pp. 25-28, 6 figs. Studding is used where weld is in such position that parts are not free to align themselves to contracting strains which result during cooling. Paper read before Metropolitan Section, Am. Welding Soc.

Tests. Solving Some Arc Welding Problems, A. M. Candy. Foundry, vol. 49, no. 5, Mar. 1, 1921, pp. 179-185, 19 figs. Experiments on strength of welds, current values under varied conditions and rates of cutting different materials. Paper read before Am. Foundrymen's Assn.

EMPLOYMENT MANAGEMENT

Interviewing Applicants. Interviewing for Selection, Earl B. Morgan. Indus. Management, vol. 61, no. 5, Mar. 1, 1921, pp. 159-164. Qualifications required for interviewing successfully.

Selection of Employees. Hiring and Placing Men. Iron Age, vol. 107, no. 11, Mar. 17, 1921, pp. 705-706. Methods followed at works of Am. Rolling Mill Co.

ENGINEERS

Registration. The Licensing of Engineers. Min. & Sci. Press, vol. 122, no. 9, Feb. 26, 1921, pp. 297-298. Bill has been introduced in Montana Legislature proposing to create State Board of Engineering Examiners for purpose of licensing engineers. Articles gives report on bill prepared by committee of Montana Section, Am. Inst. Min. & Metallurgical Engrs. Committee are adverse against passing of bill on ground that it is not necessary and that it will impose burden in time and money on engineers.

Remuneration. Incomes in Engineering Profession Compared with Others. Eng. News-Rec., vol. 86, no. 9, Mar. 3, 1921, p. 387, 2 figs. Iowa Engineering Society investigation of net income of doctors, lawyers and dentists indicates engineers low.

EVAPORATORS

Power Test Code. Test Code for Evaporating Apparatus. Mech. Eng., vol. 43, no. 3, Mar. 1921, pp. 184-187. Preliminary draft of third of series of nineteen codes in preparation by Am. Soc. Mech. Engrs. Committee on power test codes. Code is intended primarily for apparatus heated by steam such as vacuum pans, or single and multiple-effect evaporators.

EXECUTIVES

Qualifications. Getting Executive Leadership, W. R. Basset. Am. Mach., vol. 54, no. 12, Mar. 24, 1921, pp. 492-496. Danger of over-organization. One-man versus committee form of control. Advantages of competitive decentralization.

EXHAUST STEAM

Utilization of. Power from Exhaust Steam. Power Plant Eng., vol. 25, no. 6, Mar. 15, 1921, pp. 303-307, 10 figs. Installation of turbo-generators driven by exhaust steam at plant of Western Drop Forge Co., Marion, Ind.

F

FACTORIES

Reinforced-Concrete. Extension to Dunlop Tire Co.'s Plant, Toronto. Can. Engr., vol. 40, no. 9, Mar. 3, 1921, pp. 259-263, 9 figs. Flat-slab reinforced concrete construction. Four-way system and hooped interior columns.

FACTORY MANAGEMENT

See Industrial Management.

FANS, CENTRIFUGAL

Performance. Centrifugal Fans or Blowers, Their Performance and Functions, Fred R. Still. Jl. Engrs. Club of Phila., vol. 38, no. 194, Feb. 1921, pp. 72-76. Notes on design, performance and application.

Steel Works. Fatigue and Efficiency in an Iron and Steel Works, H. M. Vernon. Eng. and Indus. Management, vol. 5, no. 7, Feb. 17, 1921, pp. 201-208, 5 figs. Data compiled by British Ind. Fatigue Research Board.

FERROALLOYS

Iron-Nickel. Iron: Nickel Alloys, Paul D. Merica. Chem. & Metallurgical Eng., vol. 24, no. 9, Mar. 2, 1921, pp. 375-378, 7 figs. Properties and behavior of iron-nickel alloys.

See also Ferromanganese; Ferrosilicon.

FERROMANGANESE

Manufacture in Electric Furnace. Manufacture of Ferromanganese in the Electric Furnace, Robert M. Keeney and Jay Lonergan. Min. & Metallurgy, no. 170, Feb. 1921, pp. 30-31, 2 figs. Electric-furnace production of ferromanganese in 1920 amounted to 10,000 tons. There are now installed 33 electric furnaces of from 350 kva. to 5000 kva. capacity with total installed transformer capacity of 58,000. (Abstract.)

FERROSILICON

Properties. Influence of Silicon Upon the Properties of Ferrosilicon, A. T. Lowzow. Chem. & Metallurgical Eng., vol. 24, no. 11, Mar. 16, 1921, pp. 481-484, 9 figs. Investigation of samples of ferrosilicon containing from 49.1 per cent to 77.46 per cent silicon. Physical and chemical properties were determined. Translated from Tidskrift for Kemi.

FITS

Forced. Chart of Pressures for Forced Fits. Machy. (London), vol. 17, no. 439, Feb. 24, 1921, p. 648, 1 fig. Chart for determining pressure required to assemble parts having forced fits. Computed from standard formulas.

FORGING

Hydraulic-Press Operations. Hydraulic Forge Press Operations. Am. Mach., vol. 54, no. 11, Mar. 17, 1921, pp. 467-469, 3 figs. Data on work required for punching operation. Examples of forging various types of shells and tubes.

FOUNDATIONS

Bearing Value of Soils. Progress Report of the Special Committee to Codify Present Practice on the Bearing Value of Soils for Foundations. Proc. Am. Soc. Civil Engrs., vol. 47, no. 2, Feb. 1921, pp. 9-31, 9 figs. Definitions of soils and their mineral composition, procedure for ensuring uniformity of practice in regard to color of soils and revision and rearrangement of important factors in soil classification.

FOUNDING

Research. The Value of Scientific Research to Iron Founding, J. G. Pearce. Foundry Trade Jl., vol. 23, no. 234, Feb. 10, 1921, pp. 123-124. Experience of British Cast Iron Research Assn.

FOUNDRIES

Layout. Types of Foundry Buildings. Foundry Trade Jl., vol. 23, no. 236, Feb. 24, 1921, pp. 170-171, 1 fig. Suggested layout for foundries.

Waste Reclamation. The Reclamation of Metals from Foundry Waste, J. P. Norrie. Can. Chem. & Metallurgy, vol. 5, no. 3, Mar. 1921, pp. 77-79, 3 figs. Reclaiming and smelting process of Rome Brass & Copper Co., Rome, N. Y.

FUELS

Industrial Uses. Form Value of Energy in Relation to Its Production, Transportation and Application, Chester G. Gilbert and Jos. E. Pogue. Forging & Heat Treating, vol. 7, no. 2, Feb. 1921, pp. 139-144, 2 figs. Factors covering selection of fuel for industrial heating. Comparative cost per B.t.u. at unit prices for bituminous and anthracite coal, natural gas, city gas, oil fuel, kerosene oil, gasoline and electricity.

Liquid and Gaseous from Coal. Coal as a Future Source of Oil Fuel Supply Arthur Duckham. Jl. Instn. Petroleum Technologists, vol. 7, no. 25, Jan. 1921, pp. 3-12 and (discussion), pp. 13-26. Scheme for manufacture of liquid and gaseous fuels from coal is suggested which involves total gasification of coal in one vessel, and condensation and recovery of volatiles in liquid form, distillation being carried out at such temperatures and in such manner that minimum of cracking takes place.

See also Automobile Fuels; Coal; Lignite; Oil Fuel; Peat; Pulverized Coal; Water Gas.

FURNACES, BOILER

Rotating-Hearth. A New Type of Mechanical Furnace—The Rotating Hearth Romanet Furnace (Un nouveau type de foyer mécanique: la grille à sole tournante), A. Colomb. Chaleur et Industrie, vol. 2, no. 1, Jan. 1921, pp. 27-34, 7 figs. Fire grate is circular and rotates continuously in horizontal plane.

FURNACES, FORGING

Gas-Fired. The Application of Gas Fuel to Forging. Iron Age, vol. 107, no. 11, Mar. 17, 1921, pp. 703 and 745-746. Requirements for satisfactory forging-furnace fuel. Comparison of gas with oil and coal.

Siemens. Small Forge Furnace of Regenerative Type, F. J. Denk. Forging & Heat Treating, vol. 7, no. 2, Feb. 1921, pp. 107-108 and 111, 4 figs. European progress in design of Siemen's regenerative type of forging furnace.

FURNACES, HEAT-TREATING

Car vs. Car-and-Ball Type. Car Type and Car-and-Ball Type Furnaces. Forging & Heat Treating, vol. 7, no. 2, Feb. 1921, pp. 112-119, 9 figs. Factors determining selection of type of heat-treating furnace.

FURNACES, HEATING

Gas-Burning. The Possibilities of Gaseous Heating, W. Newton Booth. Gas Jl., vol. 153, no. 3011, Jan. 26, 1921, pp. 223-227, 4 figs. Data on efficiency of gas-burning furnaces. Paper read before London & Southern District Junior Gas Assn.

Stoker-Fired. Stoker Fired Heating Furnace Installation, Nelson G. Phelps. Forging & Heat Treating, vol. 7, no. 2, Feb. 1921, pp. 123-126, 7 figs. Data on performance of heavy-duty plate and angle-heating furnaces installed by New York Shipbuilding Corporation.

FURNACES, INDUSTRIAL

Gas-Fired. Gas Furnaces for Melting Non-Ferrous Metals, M. A. Combs. Chem. & Metallurgical Eng., vol. 24, no. 12, Mar. 23, 1921, pp. 515-516, 1 fig. Economical comparison of gas-fired furnaces with electric furnaces and oil-fired furnaces.

G

GAGES

Block. New Precision Measuring Device. Machy. (N. Y.), vol. 27, no. 7, Mar. 1921, pp. 657-658, 2 figs. Device for measuring within hundred-thousandth part of an inch by use of only six precision-measuring blocks, designed by B. M. W. Hanson, Hartford, Conn.

Interference Bands. The Hilger Interference Gauge. Engr., vol. 131, no. 3398, Feb. 11, 1921, p. 157, 3 figs. Shows with certainty differences of 0.00001 in. and permits estimation of differences of 0.000001 in.

GAS

Industrial Uses. Conserving Coal through the Use of Gas, W. A. Ehlers. Coal Age, vol. 19, no. 9, Mar. 3, 1921, pp. 397-400, 3 figs. Elimination of waste through easy regulation and control of heat within narrow limits is cited as advantage of gas over coal for industrial uses.

GAS MANUFACTURE

Dayton Process. The Dayton Process, F. C. Binnall. Jl. Indus. & Eng. Chem., vol. 13, no. 3, Mar. 1921, pp. 242-246, 5 figs. Air-oil gas process in which partial combustion of certain constituents of oil takes place within retort or reaction chamber itself, thus supplying internally all heat necessary for thermal decomposition of hydrocarbons.

Mixing Various Coals. Mixed Coal Experiments, Wm. C. Butterworth. Gas Rec., vol. 19, no. 5, Mar. 9, 1921, pp. 11-13. Tests of mixing various coals for gas making. Scheme has been developed to improve quality of coke and reduce coal costs.

GAS TURBINES

Holzwarth. A New Gas Turbine. Engr., vol. 131, no. 3398, Feb. 11, 1921, pp. 143 and 145. Resumption at works of Thyssen & Co. of experiments with gas turbine invented by H. Holzwarth, described in Engr., Dec. 8, 1911 and Jan. 5, 1912. Tests are being directed to obtaining of more economical pressure of exploding gas, and it is reported that they have been largely successful in so far as effective pressure of 170 lb. to 200 lb. per sq. in. is now obtained, as against 70 lb. to 85 lb. per sq. in. formerly.

GASOLINE

Production in United States. Quality of Gasoline Marketed in the United States, H. H. Hill and E. W. Dean. Dept. of Interior, Bur. of Mines, bul. 191, 1920, 275 pp., 22 figs. Production in U. S. has increased approximately 7,000,000 bbl. for calendar year of 1918. Quantity of crude oil handled in refineries has increased from 67,000,000 bbl. in 1901 to 326,000,000 bbl. in 1918. Yield of gasoline 42-gal. bbl. of crude oil has increased from 413 gal. in 1904 to 11 gal. in 1918.

GEAR CUTTING

Machine for. Machine for Cutting Small Spur or Bevel Gears. Machy. (London), vol. 17, no. 439, Feb. 24, 1921, pp. 647-648, 4 figs. Knee-type horizontal machine built by T. Ratcliffe, Manchester, England.

Reinecker Turbine Reduction-Gear Hobbing Machines. Am. Mach., vol. 54, no. 10, Mar. 10, 1921, pp. 416-417, 4 figs. Three large German machines for hobbing gears up to 19½ ft. in diameter. Traversing hob used.

Rapid. Some Examples of Fast Gear Cutting, S. A. Hand. Am. Mach., vol. 54, no. 12, Mar. 24, 1921, pp. 503-504, 4 figs. Practice at shop of Gould & Eberhardt, Newark, N. J.

GEARS

Bevel. Generating Bevel Gears, H. E. Kitchen. Machy. (London), vol. 17, no. 440, Mar. 3, 1921, pp. 669-670, 4 figs. Attachment manufactured by Matterson, Ltd., England, for generating bevel gears on shaping machine.

Inspection. Proposed Methods of Automotive Gear Inspection. Automotive Industries, vol. 44, no. 11, Mar. 17, 1921, pp. 609-610. Gear Makers' Assn. developing standard practice for inspection of their product. Size of hole, wear of gages, tapered holes, keyways, tooth bearing, splined shafts and methods of test are some of items considered.

Involute. The Involute Gear, Francis W. Shaw. Machy. (London), vol. 17, no. 438, Feb. 17, 1921, pp. 617-618, 10 figs. Fisher segmental involute tooth.

The Maag System of Gearing. Machy. (Lond.), vol. 17, no. 437, Feb. 10, 1921, pp. 575-581, 13 figs. System developed by Max Maag, Zurich. Standards for pitches, relations between addenda and dedenda and pressure angle are subsidiary, that is, any pitches are possible.

Spiral. Chart for Selecting Spiral Gears, C. W. Mapes Machy. (N. Y.), vol. 27, no. 6, Feb. 1921, pp. 569-570, 1 fig. Chart developed to aid in selecting and calculating spiral gears with shafts at right angles to each other.

GLASS MANUFACTURE

Machinery for. Machinery for Glass Manufacture. Engr., vol. 131, no. 3400, Feb. 25, 1921, pp. 204-206 and 208, 7 figs. British types of bottle-making machines.

GRINDING

Cylindrical. Cylindrical Grinding in 1920, W. H. Chapman. Mech. Eng., vol. 43, no. 3, Mar. 1921, pp. 173-176, 2 figs. Study of laws involved in cylindrical grinding and analysis of grinding action both for draw-in cuts and traversed cuts. Formulas are derived for wheel wear in terms of known variables such as grain size of wheel, work speed, wheel speed, feed, etc. Production costs are also discussed as well as factors that should be considered in securing highest possible grinding efficiency.

Diamonds. Diamonds for Industrial Purposes, Maurice S. Dessau. Abrasive Industry, vol. 2, no. 1, jan. 1921, pp. 8-9, 8 figs. Machine and processes for grinding diamonds.

Dust Removal. Reducing Grinding Hazards. Abrasive Industry, vol. 2, nos. 2, and 3, Feb. and Mar., 1921, pp. 37-41, 9 figs., and 101-105, 8 figs. Constant inhalation of abrasive dust causes serious pulmonary affections. Causes of excessive dust and its disposal are explained. Attention to work rests, it is claimed, will eliminate many accidents.

H

HANDLING MATERIALS

Factories. Intra-Factory Transportation, L. R. Clapp. Indus. Management, vol. 61 no. 5 Mar. 1, 1921, pp. 195-197. Practice of Ford Motor Co.

Putting the Factory Floor on Wheels. Factory, vol. 26, no. 4, Feb. 15, 1921, pp. 475-479, 18 figs. System of handling materials installed in plant of Automatic Electric Washer Co.

Railways. Problems of Handling Material and Freight on Railroads, Charles N. Winter. New England Railroad Club, Feb. 8, 1921, pp. 289-323. Equipment used.

HARBOUR IMPROVEMENTS

Toronto. Toronto Harbour Improvements, Edward L. Cousins. Jl. of the Eng. Inst. of Canada, vol. 4, no. 3, Mar. 1921, pp. 177-195, 11 figs. Account of progress in construction of facilities for industrial and commercial expansion and coordination of transportation facilities and water traffic.

HEALTH

Industrial. Health Service in Industry. Nat. Indus. Conference Board ,report no. 34, Jan. 1921, 61 pp., 2 figs. Survey of developments in organization of medical department in industries, and discussion of method of procedure which have been applied advantageously in individual establishments.

HEATING, ELECTRIC

Advantages. Electric Heating and the Importance of Its Developments in France (Le chauffage électrique et les avantages de son développement en France). Génie Civil, vol. 78, no. 7, Feb. 12, 1921, pp. 148-151, 2 figs. Economic comparison of electric heating with other heating processes. Survey of developments in industrial electric heating in U. S., Canada, Scandinavian countries, Switzerland, etc.

Household Uses. Thermal Characteristics of Electric Ovens and Hot Plates. Engineer, vol. 131, no. 3399, Feb. 18, 1921, pp. 176-177. Tests at National Physical Laboratory, England, on efficiency of hot plates for roasting, baking, frying and boiling.

HEATING, HOT-AIR

Research. Progress Report of Committee on Furnace Heating, A. C. Willard and A. P. Kratz. Jl. Am. Soc. Heat & Vent. Engrs., vol. 27, no. 2, Mar. 1921, pp. 124-132, 4 figs. Proposed furnace-testing codes for both pipeless and piped furnace systems as developed in warm-air furnace research work at University of Illinois.

HEATING, HOT-WATER

Forced-Circulation System. Forced Hot-Water Circulation Heating System, Girard Estate, Philadelphia, Robert Hughes. Jl. Am. Soc. Heat & Vent. Engrs., vol. 27, no. 2, Mar. 1921, pp. 107-108, 7 figs.

HEAVY-OIL ENGINES

Ingersoll-Rand. A New Development of the Heavy Oil Engine, F. A. McLean. Power House, vol. 14, no. 4, Feb. 20, 1921, pp. 26-29, 4 figs. Ingersoll-Rand, Price Rathbun Type.

HOBBING MACHINES

See Gear Cutting, Machines for.

HOISTS

Electrically Operated. Marine Railways, C. B. Connely. Gen. Elec. Rev., vol. 24, no. 3, Mar. 1921, pp. 240-243, 8 figs. Typical installations of electric hoists at American drydocks.

Skip. Skip Hoisting for Coal Mines, Andrews Allen and John A. Garcia. Min. & Metallurgy, no. 170, Feb. 1921, pp. 35-36. Advantages of skip hoisting are: Hoisting capacity capable of taking care of all coal and rock that can be mined; smaller shaft; and large ratio of lading to gross weight.

Why Some Operators are Substituting Skips for Cages in the Hoisting of Coal, Andrews Allen and John A. Garcia. Coal Age, vol. 19, no. 11, Mar. 17, 1921, pp. 485-489, 4 figs. Modifications in design necessary where large coal must be produced. Paper read before Am. Inst. Min. & Metallurgical Engrs.

HOSE COUPLINGS

Air Brakes. Repairing Air-Brake Hose Connections, J. V. Hunter. Am. Mach., vol. 54, no. 9, Mar. 3, 1921, pp. 377-378, 6 figs. Pneumatic devices used at Decatur car shops of Wabash Railway Co.

HOUSING

Concrete Dwellings Limited, Westminster. The "C. D. L." System of Concrete Construction. Concrete & Constructional Eng., vol. 16, no. 2, Feb. 1921, pp. 118-123, 7 figs. Solid walls, or hollow walls with concrete ties are constructed by means of traveling mold. In case of hollow-wall mold is provided with core; if solid wall is desired, core is absent.

Hayes, England. Concrete Cottage Building. Hayes Housing Scheme. Concrete & Constructional Eng., vol. 16, no. 2, Feb. 1921, pp. 105-111, 9 figs. Houses erected with solid concrete walls and timber shuttering.

Industrial, U. S. Housing by Employers in the United States, Leifur Magnusson. U. S. Dept. of Labour, Bur. of Labour Statistics, no. 263, Oct. 1920, 283 pp., 111 figs. Representative examples of manufacturing towns and mining communities.

HYDRAULIC TURBINES

Water Measurement. New Method of Water Measurement in Efficiency Tests of 37,500-hp. Turbines, N. R. Gibson. Power, vol. 53, no. 12, Mar. 22, 1921, pp. 452-458, 17 figs. Efficiency tests of three units in station of Niagara Falls Power Co. are described with particular reference to application of Gibson method and apparatus for measuring flow of water in penstocks. Paper read at joint meeting of Engrs. Club of Phila. & Phila Sections of Am. Soc. Civil Engrs., Am. Inst. Elec. Engrs. & Am. Soc. Mech. Engrs.

Wheel for. New Type of Wheel for Hydraulic Turbine (Tipo nuevo de rueda para turbina hidràulica), Forrest Nagler. Ingenieria Internacional, vol. 5, no. 4, April 1921, pp. 206-208, 2 figs. Four-bladed propeller rotating at 50 r.p.m.

HYDROELECTRIC PLANTS

Automatic. Automatic Hydroelectric Plants for Power and Lighting, T. A. E. Belt. Elec. Rev. (Chicago), vol. 78, no. 11, Mar. 12, 1921, pp. 417-420, 5 figs. Types of control and regulating equipment available for use with stations operating without individual attendants.

Economical Operation. Note on a System for Accumulation of Energy Which Permits more Economical Operation of an Hydroelectric Central Station (Di un sistema di accumulazione d'energia, per una migliore utilizzazione delle centrali idroelectriche), Alfredo Mauerfi. Elettrotecnica, vol. 8, no. 4, Feb. 5, 1921, pp. 63-75. Thermal electric installation at Olten, Switzerland.

England. The Lochaber Hydro-Electric Scheme. Engr., vol. 131, no. 340, Mar. 4, 1921, pp. 226-227, 2 figs. Scheme for production of from 70,000 to 75,000 hp. continuously.

North Wales. Actual and Projected Water Power Developments in North Wales. John B. C. Rershaw, Engr., vol. 131, no. 3400, Feb. 25, 1921, pp. 195-198, 10 figs. Developments contemplated will furnish an additional 35,000 kw. at 34,600 volts.

Pressure Shafts. The Calculation of Pressure Shafts (Zur Berechnung von Druckschächten), J. Büchi. Schweizerische Bauzeitung, vol. 77, nos. 6, 7 and 8, Feb. 5, 12 and 19, 1921, pp. 61-63, 73-76 and 88-91, 11 figs. Notes on investigation of an Austrian pressure shaft through rock, dealing with general construction procedure and the separate problems; calculation of influence of the internal water pressure; influence of contraction of the concrete, and of temperature; insufficient laying on of concrete; longitudinal and round joints; drainage of pipe; pressure of soil; rust deterioration; comparison of costs.

Weedon, P. Q. Hydro-Electric Plant at Weedon, P. Q., for City of Sherbrooke. Contract Rec., vol. 35, no. 10, Mar. 9, 1921, pp. 229-230, 4 figs. Plant will develop 4000 hp. and deliver energy at 50,000 volts along transmission line 28 miles long.

See also Water Power.

I

ICE PLANTS

Electrically Operated. Electrically Operated Ice Plants, Reginald Trautschold. Refrigerating World, vol. 56, no. 3, Mar. 1921, pp. 12-13. Development of electric drive for ammonia compressors.

INDUSTRIAL MANAGEMENT

Administrative Research. Industrial Research in the Art of Man Management, Erwin H. Schell. Am. Mach., vol. 54, no. 9, Mar. 3, 1921, pp. 364-367. Administrative research recommended for standardization of policies. Questionnaire suggested.

Chemical Plants. Taking Industrial Chemistry Into Partnership—I, Frederic Dannerth. Indus. Management, vol. 61, no. 5, Mar. 1, 1921, pp. 151-154. Standard practice for chemical industry process management.

Legislation. The Future of Industrial Management, F. M. Lawson. Jl. Royal Soc. of Arts, vol. 69, no. 3559, Feb. 4, 1921, pp. 164-171 and (discussion) pp. 171-175. Discusses enacting of future legislation for promotion of industrial peace.

Planning Departments. Practical Organization Principles, G. Sumner Small. Indus. Management, vol. 61, no. 5, Mar. 1, 1921, pp. 183-186. Principles underlying practical organization of industrial departments.

Production Systems. Color Cycle Production Control, Carle M. Bigelow. Indus. Management, vol. 61, no. 5, Mar. 1, 1921, pp. 168-170, 4 figs. Method adopted in knitted underwear plant.

Controlling the Flow of Production, H. K. Hathaway. Indus. Management, vol. 61, no. 5, Mar. 1, 1921, pp. 175-179, 5 figs. How to keep track of split or broken lots on single route-sheet.

Increasing Production by a Rational Piece-Work System, John C. Spence. Machy. (N. Y.), vol. 27, no. 6, Feb. 1921, pp. 519-520. Experiences of manufacturers with piece-work system.

Modern Production Methods—XV, W. R. Basset. Am. Mach., vol. 54, no. 10, Mar. 10, 1921, pp. 398-402, 7 figs. Forms for accounting for supplies.

Production Methods of Rolls-Royce Plant. Iron Age, vol. 107, no. 9, Mar. 3, 1921, pp. 555-559, 4 figs. Experience of automobile factory built in America along lines of English works.

System for Production Control. Machy. (N. Y.), vol. 27, no. 7, Mar. 1921, pp. 647-650, 8 figs. Methods employed in plant of Am. Multigraph Co., for recording progress of work.

Safety. Safety Organization in Machine Shops. Eng. & Indus. Management, vol. 5, no. 8, Feb. 24, 1921, pp. 232-233. Safety organization of typical firm.

Safety Methods Applied in the Ryerson Steel-Service Plants. Chem. & Metallurgical Eng., vol. 24, no. 8, Feb. 23, 1921, pp. 351-354, 6 figs. Outline of general organization for safety promotion in plants and of results leading to better relationship between management and workers and to ultimate reduction of plant-operating costs and higher efficiency.

Shop Methods. Sharpening Up Dull Periods. Factory, vol. 26, no. 6, Mar. 15, 1921, pp. 718-723. From results of questionnaire to 325 plants asking them for description of their practices in slack times.

Storing Materials. Stores Engineering, M. T. Montgomery. Proc. Engrs. Soc. Western Pennsylvania, vol. 36, no. 10, Jan. 1921, pp. 641-673 and (discussion) pp. 674-682, 26 figs. Storekeeping practice of Pittsburgh Railways Co.

Systems. Idealism as a Factor in Management, Herbert Rollin White. Indus. Management, vol. 61, no. 5, Mar. 1, 1921, pp. 165-167. Application of "golden rule" in industrial management. Examples of successful management.

Toolroom Organization. A Tool System That Speeds Production, William J. Burger. Factory, vol. 26, no. 4, Feb. 15, 1921, pp. 458-460, 6 figs. Toolroom organization of Warner & Swasey Co.

INDUSTRIAL RELATIONS

Department of. Industrial Relations Departments, James W. Brown. Foundry, vol. 49, no. 6, Mar. 15, 1921, pp. 229-231. Advantages derived from promoting family spirit in industrial life of employees. Paper read before Am. Foundrymen's Assn.

See also Time Study.

Syndical Control, Italy. Syndical Control of Industries in Italy (A Propos du contrôle syndical des industries en Italie). Revue générale de l'Électricité, vol. 9, no. 9, Feb. 26, 1921. pp. 289-296. Text of projects submitted to Italian Government by Italian Federation of Intellectual Workers and by Italian General Federation of Industry, together with text of project devised by Italian Government.

INLAND NAVIGATION

Electric Hauling on Canals. New Systems of Electric Hauling on Canals (Nouveaux systèmes de halage électrique sur les canaux), Ed. Imbeaux. Nature (Paris), no. 2441, Jan. 15, 1921, pp. 33-37, 5 figs. Developments in France.

INSULATORS, ELECTRIC

Paper. The Effect of Heat on Paper Insulation, H. W. Fisher and R. W. Atkinson. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 3, Mar. 1921, pp. 183-191, 5 figs. Discussion of mechanical properties of paper especially as influenced by drying, heating and impregnating. Tests for measuring changes due to these causes are discussed and it is shown that tensile tests are unsatisfactory for this purpose. Measurement of tearing resistance is found to be satisfactory and two machines for this purpose are described.

Performance. Operating Performance of Insulators on a 45,000-Volt System, H. B. Vincent. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 1, Jan. 1921, pp. 30-34, 13 figs. Data pertaining to condition of pin-type high-tension insulators removed from service, with percentage of injured and damaged insulators to total installed and percentage of nature of damage to total failures.

INSULATORS, HEAT

Tests. Heat Insulating Properties of Cork and Lith Board, A. A. Porter, J. P. Coulderwood, A. J. Mack and L. S. Hobbs. Power Plant Eng., vol. 25, no. 5, Mar. 1, 1921, pp. 285-286, 4 figs. Tests made in Engineering Experiment Station of Kansas State Agricultural College. Cork board showed heat insulating properly approximately 5 per cent greater than lith board.

Relative Heat Conductivities of Some Insulating and Building Materials, James J. Lichtin. Chem. & Metallurgical Eng., vol. 24, no. 9, Mar. 2, 1921, p. 388, 2 figs. Experimental measurements.

INTERNAL-COMBUSTION ENGINES

Efficiency Determination Determination of the Mechanical Efficiency of Internal-Combustion Engines, V. L. Maleev. Gas Engine, vol. 23, no. 3, Mar. 1921, pp 53-58, 7 figs. Type of brake constructed by writer for testing high-pressure Diesel engine of 140 b.hp.

Indicator Diagrams. A High-Speed Engine Pressure Indicator of the Balanced Diaphragm Type, H. C. Dickinson and F. B. Newell. Nat. Advisory Committee for Aeronautics, no 107, 15 pp., 14 figs. Principle involved is balancing of engine cylinder pressure against measured pressure on opposite sides of metal diaphragm of negligible stiffness Phase of engine cycle to which pressure measurement corresponds is selected by timing device.

Two-Stroke. The Record Two-Stroke Engine. Engr., vol. 121, no. 3402, Mar. 11, 1921, pp. 270-271, 2 figs. Absence of poppet valves is feature of internal-combustion engines manufactured by Record Eng. Co., London. Valves are replaced by arrangement of twin working pistons and piston valve, latter being operated by means of eccentric formed solid with crankshaft and being utilized for distributing explosive mixture to cylinders.

See also Aeroplane Engines; Automobile Engines; Diesel Engines; Heavy-Oil Engines; Oil Engines; Semi-Diesel Engines; Tractor Engines.

J

JIGS

Manufacture. Building Jigs and Fixtures on Manufacturing Basis, W. H. Vockell and H. C. Uihlein. Machy. (N. Y.), vol. 27, no. 7, Mar. 1921, pp. 632-635, 11 figs. Standardization of details to permit production in quantity at reduced cost. Practice of Cincinnati Eng. Tool Co.

Using Compound Slide in Jig and Die Making. Machy. (N. Y.), vol. 27, no. 7, Mar. 1921, pp. 630-631, 4 figs. How Johansson compound slide is used in toolroom work, especially in laying out of accurately spaced holes.

L

LABOUR

Hours of Work. Practical Experience With the Work Week of Forty-Eight Hours or Less. Nat. Indus. Conference Board, research report no. 32, Dec. 1920, 88 pp. Based on experience of manufacturers extending over varying periods. It was desired to determine whether or not 48 hr. schedule would yield the same, or practically the same, weekly output per worker as previous longer schedule in same plants and under substantially same conditions.

See also Industrial Relations; Industry.

LADLES

Stopper. Proved Design for Ladle Stopper. Foundry, vol. 49, no. 6, Mar. 15, 1921, pp. 219-222, 3 figs. Means provided for taking care of expansion of sleeve. Taper of bottom sleeve for acid practice.

LATHE TOOLS

Multiple Inserted Cutters Efficiency Tests with Tools with Multiple Inserted Cutters (Leistungsversuche mit Stählen mit mehrfacher Schneide), Hermann Brsöamlen. Betrieb, vol. 3, no. 8, Jan. 25, 1921, pp. 213-215, 1 fig. Described tests show that by use of profile tools (Jäger tools, patented), an increase in production without increase of means of production can be obtained, due to the combined arrangement of the tools and especially to reduction of the unproductive working period.

LATHES

Bench. Tools and Methods for Manufacturing Precision Bench Lathes—I, Fred R. Daniels. Machy. (N. Y.), vol. 27, no. 7, Mar. 1921, pp. 668-672, 8 figs. Practice of S. A. Potter Tool & Machine Works, New York City, in manufacture of bench lathes.

Cadillac. The Cadillac Vertical Lathe, J. V. Hunter. Am. Mach., vol. 54, no. 12, Mar. 24, 1921, pp. 489-491, 5 figs. Semi-automatic compact machine intended for single-purpose work.

Lead-Screw Variator. Lathe Lead Screw Variator Device. Iron Age, vol. 107, no. 9, Mar. 3. 1921, pp. 569, 2 figs. Device consists of bracket unit clamped to ways of lathe, lead screw mechanism and rods connecting variator nut with lathe carriage. Manufactured by Precision & Thread Grinder Mfg. Co., Philadelphia.

Stud and Bolt. Automatic Stud and Bolt Machine. Engineering, vol. 111, no. 2879, Mar. 4, 1921, pp. 252, 5 figs. Machine designed for straight forward stud and bolt work. Machine is provided with automatic chuck for machining bolts 1½ in. in diameter; range of studs dealt with is from ½ in. to 1¼ in., with maximum length of 9 in.

Turret. Obtaining Production on the Vertical Turret Lathe. Machy. (N. Y.), vol. 27, no. 6, Feb. 1921, pp. 534-540, 18 figs. Application of Bullard vertical turret lathe to machine-shop practice, including typical examples and description of tooling used.

Turret Lathe Applications, J. H. Moore. Can. Machy., vol. 25, no. 6, Feb. 24, 1921, pp. 38-41, 16 figs. Tooling necessary for machining axle housing, motor frame, and piece of work weighing over 600 lbs.

LIGHTING

Illumination Standards Practical Illumination Design Method and Data, Earl A Anderson. Elec Rev (Chicago), vol. 78, no 11, Mar 12, 1921, pp. 411-415, 8 figs Table giving present standards for illumination for various services. (To be continued.)

Industrial. Industrial and Factory Lighting. Jl Electricity & Western Industry, vol. 46, no. 4, Feb. 15, 1921, pp. 186-187, 4 figs Investigation in 446 industrial plants brought out that average of approximately 25 per cent of work done is carried on under artificial illumination

The Human Factor in Industrial Lighting, James R. Cravath. Jl. Electricity & Western Industry, vol 46, no. 4, Feb. 15, 1921, pp 181-183, 2 figs Tests showing effect of improved artificial lighting on output in number of industrial plants.

Standards for the Lighting of Interiors. Illuminating Engr., vol. 13, no. 10, Oct.-Dec. 1920, pp. 275-276. Standards recommended by special committee Illuminating Eng. Soc. of Germany. Translated from Elecktrotechnische Zeitschrift.

Streets. Street Lighting in City and Town, Reginald Trautschold. Am. City, vol. 24, no. 3, Mar. 1921, pp. 238-242, 3 figs. Systems of electric street lighting.

LIGNITE

Briquetting. The Manufacture of Lignite Briquettes. Eng. Progress, vol. 2, no. 2, Feb. 1921, pp. 25-28, 7 figs. Description of briquetting factory.

Drying. Lignite (Le lignite), Jean C. Verdier. Revue de l'Ingénieur, et Index Technique, vol. 28, no. 1, Jan. 1921, pp. 9-16, 4 figs. Formula and graph for determining quantity of water to be removed by grinding. (Continuation of serial.)

LOCOMOTIVE BOILERS

Insulation. The Insulation of Locomotive Boilers, Wm. N. Allman. Ry. Rev., vol. 68, no. 10, Mar. 5, 1921, pp. 349-350, 2 figs. Efficiency curves of 85 per cent magnesia lagging.

LOCOMOTIVES

Electric. *See Electric Locomotives.*

European Designs. Recent Trend in Locomotive Design in Europe. Mech. Eng., vol. 43, no. 3, Mar. 1921, pp. 189-192, 8 figs. Three-cylinder fast-freight locomotive in operation in English railway, and German internal-combustion mine locomotives.

Feedwater. *See Boiler Feedwater, Treatment.*

Freight, Tests. Design and Tests of Freight Locomotives on the Pennsylvania Railroad, Lawford H. Fry. Engineering, vol. 111, no. 2877, Feb. 18, 1921, pp. 190-191, 2 figs. Graphs showing speed and drawbar pull of various types. (To be continued.)

Fuel Consumption. Train Schedules and Locomotive Fuel Consumption, Edwin Winfield. Can. Ry. & Mar. World, no. 277, Mar. 1921, pp. 124-126, 4 figs. Graphs indicating variation in coal consumed with power exerted.

Pulverized-Coal-Burning. Locomotive Burning Pulverized Coal (L'application du charbon pulvérisé aux locomotives). Outillage, vol. 5, no. 4, Jan. 27, 1921, pp. 98-101, 5 figs. Italian locomotives equipped to burn pulverized lignite, also Swedish locomotives with Euller system for burning pulverized peat.

Shop Equipment. Locomotive Shop Equipment on Wheels, J. V. Hunter. Am. Mach., vol. 54, no. 10, Mar. 10, 1921, pp. 403-404, 6 figs. Locomotives transferred to repair pits by travelling crane. Time saved by taking portable workbenches and machine tools to work.

LUBRICATING OILS

Centrifugal Cleaner. Centrifugal Oil Cleaner. Oil News, vol. 9, no. 4, Feb. 20, 1921, pp. 21-22, 2 figs. Apparatus under development at McCook Field. Oil is led from oil tanks to inside of bowl which is rotating at 2550 r.p.m. when engine is turning up 1700 r.p.m.

Dilution. Dilution of Crankcase Oil, Wm. F. Parish. Jl. Soc. Automotive Engrs., vol. 8. no. 3, Mar. 1921, pp. 231-237 and 254. 3 figs. Results of tests made on aeroplane engines to determine effect of dilution of crankcase oil. Comparative characteristics of used and reclaimed oil. Paper read before Am. Petroleum Inst.

Selection. Friction and Fuel, Wm. N. Berkeley. Power, vol. 53, no. 10, Mar. 8, 1921, pp. 390-392. Comparison of constants of asphalt-base and paraffin-base lubricating oils. Table indicating best uses for different classes of lubricating oils.

M

MACHINE TOOLS

Heavy. Some Examples of Heavy Modern Machine Tools, K. Ehmcke. Eng. Progress, vol. 2, no. 2, Feb. 1921, pp. 33-38, 15 figs. Giant portal-type milling machine with two vertical spindles and four horizontal boring and milling machines; giant milling machine with three double spindles and seven electromotors; lathe with 8.5 ft. height of centers; vertical lathe for turning diameter of 39.4 ft.

Spacing Tables. Improved Design of Spacing Table. Iron Age, vol. 107, no. 11, Mar. 17, 1921, p. 707, 3 figs. Semi-automatic machine manufactured by Cleveland Punch & Shear Works Co.

MACHINERY

Manufacture. Building Heavy Machinery. Eng. Production, vol. 2, no. 23, Mar. 10, 1921, pp. 321-325, 6 figs. Works and methods of Hick, Hargreaves, England, manufacturers of locomotives, marine engines, Lancashire and other type boilers, stationary engines of all classes, water turbines and mill-gearing.

MALLEABLE IRON

Experiments. Experiments in Malleable Iron, F. H. Hurren. Foundry Trade Jl., vol. 23, no. 234, Feb. 10, 1921, pp. 125-128 and (discussion) pp. 136-138, 6 figs. Analyses of samples and photomicrographs.

Foundries. Equips for Malleable Jobbing Work, H. E. Diller. Foundry, vol. 49, no. 5, Mar. 1, 1921, pp. 171-175, and 185, 8 figs. Foundry at Temple, Pa., where 2½ lbs. of castings are annealed with 1 lb. of coal.

Strength of. American Malleable Cast Iron—V, H. A. Schwartz. Iron Trade Rev., vol. 68, no. 9, Mar. 3, 1921, pp. 628-631 and 633. Stress-strain diagrams of malleable cast iron in compression and in shear.

METALS

Thermal Capacities. Heating Furnaces and Annealing Furnaces, W. Trinks. Forging & Heat Treating, vol. 7, no. 2, Feb. 1921, pp. 109-111, 4 figs. Graph showing heat content of pure metals at various temperatures, constructed from figures obtained in experiments conducted by the Society of German Engineers.

METRIC SYSTEM

Arguments Against Adoption in United Kingdom. Scientific England and the Metric System. Indus. Management, vol. 61, no. 5, Mar. 1, 1921, p. 154. Abstract of reports submitted by Metric Committee appointed by conjoint board of Scientific Societies of United Kingdom. It is recommended that British system of units of weights and measures be retained in general use in United Kingdom.

Arguments Against Adoption in U. S. The Metric Equivalent Scheme, Frederick A. Halsey. Machy. (N. Y.), vol. 27, no. 7, Mar. 1921, pp. 665-667, 1 fig. Arguments against contention of T. H. Miller in Machinery 1920 that it is feasible to adopt metric measurements for machines already being manufactured in English units.

MILLING MACHINES

Fixtures. Milling Machine Methods. Eng. Production, vol. 2, no. 23, Mar. 10, 1921, pp. 330-331, 11 figs. Typical fixtures designed for production milling.

MINING

Standardization of Materials. The Standardization of Mining and Milling Materials, E. A. Wraight. Min. & Sci. Press, vol. 122, no. 11, Mar. 12, 1921, pp. 361-366. Data in regard to standardization of drill steels, stamp-battery parts, rolls, balls for mills, and tube-mill liners.

MOLYBDENUM STEEL

Tests. A Discussion of Molybdenum Steels, Charles McKnight. Trans. Am. Soc. for Steel Treating, vol. 1, no. 6, Mar. 1921, pp. 288-296. Tensile tests of molybdenum steels.

Uses. Molybdenum Steels, John A. Matthews. Chem. & Metallurgical Eng., vol. 24, no. 9, Mar. 2, 1921, pp. 395-396. Also Min. & Metallurgy, no. 170. Feb. 1921, pp. 39-40. Development of molybdenum steel in America. Early experiments with this element in complex alloys for tools. Recent successful utilization in mechanical and structural steels of high strength and great adaptability.

MORTARS

Cement, Shrinkage. Shrinkage of Portland Cement Mortars and Its Importance in Stucco Construction, J. C. Pearson. Eng. & Contracting, vol. 55, no. 8, Feb. 23, 1921, pp. 187-190, 6 figs. Results of measurements on about 200 mortar slabs. Investigation conducted at U. S. Bur. of Standards. Paper read before Am. Concrete Inst.

MOTOR TRUCKS

Farm Service. Corn-Belt Farmers' Experience with Motor Trucks, H. R. Tolley and L. M. Church. U. S. Dept. Agriculture, bul. no. 931, Feb. 25, 1921, 34 pp., 3 figs. Study of 831 reports from farmers who own motor trucks.

MOTORSHIPS

Steamships vs. Advantages of Motorships Compared with Steamships. Motorship, vol. 6, no. 3, March 1921, pp. 210-211, 1 fig. Saving in space, which amounts to 30 per cent for machinery alone in favour of Diesel plant; saving of fuel, figures for motorship being about 0.33 lb. per i.hp. per hr., and for geared turbines steamship seldom below 0.990 lb. per i.hp. per hr.; no standby losses in motorships; and less cost for cleaning and repairs in motorships.

N

NAVIGATION

Leader Cables. Piloting Vessels by Electrically Energized Cables, A. Crossley. Jl. Am. Soc. Naval Engrs., vol. 33, no. 1, Feb. 1921, pp. 33-59, 14 figs. Evolution of system of piloting vessels by means of signals sent out from submerged electric cables. Audio system in its present state is considered a success from navigational standpoint.

The "Leader" Cable at Portsmouth, J. J. Bennett. Engineering, vol. 111, no. 2877, Feb. 18, 1921, pp. 187-190, 12 figs. Installations at New York, Portsmouth and Brest of submerged cable which by means of surrounding electromagnetic field operates on board ship indicating direction to be followed to enter port.

NICKEL STEEL

Tests. Static and Dynamic Tension Tests on Nickel Steel, J. J. Thomas and J. H. Nead. Min. & Metallurgy, no. 170, Feb. 1921, p. 34. Relation between static and dynamic tension tests as measured by work required to break test specimens slowly in tensile testing machine, and rapidly, by means of falling weight. (Abstract.)

O

OIL

Distillation. A New Oil Distilling Process. Petroleum Times, vol. 5, no. 110, Feb. 12, 1921, p. 185. Process of mineral-oil distillation under high vacuum by means of which mineral-oils or heavy mineral-oil residues are distilled non-destructively to solid coke. Process was developed by Leo Steinschneider, Bruenn-Koenigsfelder Maschinenfabrick, Czecho-Slovakia.

See also Petroleum.

OIL ENGINES

Cold-Starting. Cold Starting Oil Engine. Gas Engine, vol. 23, no. 3, Mar. 1921, pp. 73-74, 2 figs. Fuel consumption curves of 250 b.hp. twin-cylinder Ruston high-compression oil engine.

Hot-Bulb. A Six-Cylinder Hot Bulb Engine. Engr., vol. 131, no. 3400, Feb. 25, 1921, pp. 212-214, 4 figs. Marine engine of 450 b.hp. constructed by Vickers-Peters, Ipswich, England.

Industrial Uses. Heating by Fuel Oil for Manufacturing Processes, C. C. Hermann. Indus. Management, vol. 61, no. 5, Mar. 1, 1921, pp. 199-202. Advantages and limitation of oil fuel for industrial uses, particularly in use in forge-shop and heat-treating furnaces. Methods of purchasing, testing and storing fuel. Example illustrating how air capacity is determined for given service.

Measurement. Measurement of Fuel Oil, J. D. Gilman. Mar. Eng., vol. 26, no. 3, Mar. 1921, pp. 234-237. Tables for reducing measurement to standard conditions.

Specifications. The Saybolt Furol Viscosimeter, E. W. Dean. Reports of Investigations, Bur. of Mines, Dept. of Interior, Feb. 1921, serial no. 2215, 4 pp. Apparatus employed by Bureau of Mines in determining quality of oil fuel as required by specifications issued by U. S. Navy. Superiority of defining oil fuel in terms of viscosity rather than gravity is concluded from results of inspection work undertaken for U. S. Shipping Board.

Uses. Fuel Oil Burning in Various Parts of the World, Andrew F. Baillie. Jl. Royal Soc. of Arts, vol. 69, no. 3563, Mar. 4, 1921, pp. 232-243 and (discussion) pp. 243-246. Survey of uses, and records of comparative tests with coal and oil in similar boilers.

OIL SHALES

Analysis. The Laboratory Testing of Oil Shale for Oil and Ammonia Yield, E. Lawson Lomax and F. G. P. Remfry. Jl. Instn. Petroleum Technologists, vol. 7, no. 25, Jan. 1921, pp. 34-45 and (discussion) pp. 45-47, 1fig. Outline of procedure.

Pennsylvania. *See Coal Deposits, Pennsylvania.*

Pyrolitic Distillation. Plant Design for Hot-Gas Pyrolytic Distillation of Shale, Louis Simpson. Chem. & Metallurgical Eng., vol. 24, no. 8, Feb. 23, 1921, pp. 341-345, 2 figs. Description and plan of 2000-ton-per-day shale-oil plant operating on indirect heating process employing hot gases for conveying reacting heat and resultant oil vapors from pyrolysis of shale.

Spent Shale, Uses of. Possible Uses for the Spent Shale from Oil Shale Operations, Kirby Thomas. Chem. & Metallurgy Eng., vol. 24, no. 9, Mar. 2, 1921, pp. 389-390. Uses as fuel, as non-conductor material for electrical applications and as material for making brick.

Utilization. Some Items of Investment, Expense, and Profit in Commerc Shale-Oil Production, L. H. Sharp and A. T. Strunk. Reports of Investigations, Bur. of Mines, Dept. of Interior, Feb. 1921, serial no. 2214, 3 pp. Equipment necessary for large-scale commercial utilization of oil shales.

P

PATENT LAWS

Administration. Patent Laws and Their Administration, C. A. P. Tuner. Concrete, vol. 18, no. 3, Mar. 1921, pp. 152-154. Urges creation of technical court of appeals as protection for public.

PEAT

Use on Swedish Railways. Peat Proves Satisfactory Fuel on Swedish Railways. Commerce Reports, no. 46, Feb. 25, 1921, p. 1109. Peat is dried in open air and softest lumps are converted into powder or briquets. Tests have passed experimental stage and Railway Board of Sweden has constructed plant with capacity of 30,000 tons per annum.

PETROLEUM

World Production. World's Production of Petroleum. Eng. & Min. Jl., vol. 111, no. 10, Mar. 5, 1921, pp. 433. Production in 1920 was 688,474,251 barrels against 551,505,548 barrels in 1919. In 1920 the United States supplied 443,402,000 barrels.

See also Oil.

PHOTO-ELASTICITY

Uses in Machine Design. Photo-Elasticity for Engineers—The Use of Photo-Elastic Methods in the Design of the Elements of Machines and Structures, E. G. Coker. Gen. Elec. Rev., vol. 24, no. 3, Mar. 1921, pp. 222-227, 5 figs. Produre suggested and illustrated by application to design of eye bars.

PILES

Sheet. Sheet Piles, Frank W. Skinner. Cornell Civil Engr., vol. 29, no. 5, Feb. 1921, pp. 87-92 and 103-104, 9 figs. Advantages and disadvantages of various kinds of sheet piles and methods of driving each type.

Wooden, Concreting of. New Method of Concreting Wooden Piles. Concrete, vol. 18, no. 3, Mar. 1921, pp. 149, 3 figs. Special forms are placed around pile and then rich concrete grout is poured as each unit of form is set in place.

PISTONS

Inspection. Inspecting Pistons and connecting Rods, Fred H. Colvin. Am. Mach., vol. 54, no. 10, Mar. 10, 1921, pp. 407-410, 14 figs. Importance of inspection methods to quality of product. Methods in use on Essex and Studebaker pistons and connecting rods.

Manufacture. Manufacture of the Jahns Semi-Finished Pistons. Metal Trades, vol. 12, no. 3, Mar. 1921, pp. 95-97, 10 figs. Practice at Los Angeles plant.

PLANING

Production Systems. Production Planning in Machine Tool Plants, Edward K. Hammond. Machy. (N. Y.), vol. 27, nos. 6 and 7, Feb. and Mar. 1921, pp. 552-559, 8 figs., and 659-664, 8 figs. Methods used in shops of representative engine-lathe and planer builders.

PNEUMATIC TOOLS

Manufacture. The Manufacture of Pneumatic Tools. Machy. (London), vol. 17, no. 439, Feb. 24, 1921, pp. 636-645, 22 figs. Review of methods employed by Consolidated Pneumatic Tool Co., Scotland.

PORTS

New York. Plans for Organizing the Port of New York. Mech. Eng., vol. 43, no. 3, Mar. 1921, pp. 211 and 220, 1 fig. Automatic electric subway to eliminate surface congestion and reduce handling cost. Report presented to governors of New York and New Jersey by New York-New Jersey Port and Harbour Commission.

POWER

Industrial Supply. Industry's Supply of Energy, George Otis Smith. Mech. Eng., vol. 43, no. 3, Mar. 1921, pp. 165-166 and 188. Survey of available supplies of coal, oil, and water, together with discussion of engineer's part in economic and efficient utilization of energy units.

POWER TRANSMISSION

Hydraulic. Hydraulic Transmission of Power (La transmission hydraulique), A. Raudot. Revue générale de l'Electricité, vol. 9, nos. 6, 8 and 9, Feb. 5, 19 and 26, 1921, pp. 177-181, 18 figs., 239-243, 4 figs., and 279-284, 5 figs. System involving generator pump on rotary type with fixed cylinders arranged in star shape. Suggested design of 12-cyl. generating pump. Comparative study of characteristics of hydraulic and electric motion. Application of hydraulic transmission to railway traction.

PROFIT SHARING

Legal Aspect. Profit Sharing in Industry (La participation ouvrière aux bénéfices de la production), Paul Razous. Génie civil, vol. 78, no. 4, Jan. 22, 1921, pp. 84-87. Arguments against legal compulsion of management to establish profit-sharing system. (Concluded.)

Norway. A Norwegian Plan for Profit Sharing. Monthly Labour Rev., vol. 12, no. 2, Feb. 1921, pp. 117-119. Plan worked out by Council of Nat. Workingmen's Assn., Norway.

Plans for. Encouraging Industrial Co-operation, A. H. Dittmer. Machy (N.Y.), vol. 27, no. 6, Feb. 1921, pp. 549-551, 2 figs. Credit point system operated at plant of Dittmer Gear & Mfg. Corp., Lockport, N.Y.

PROPELLERS, SHIP

Erosion. The Erosion of Bronze Propellers, O. Silverrad. Jl. Soc. Chem. Industry, vol. 40, no. 4, Feb. 28, 1921, pp. 38T-45T, 8 figs. Also Shipbuilding & Shipping Rec., vol. 17, no. 7, Feb. 17, 1921, p. 183. Investigations into cause of deterioration. It is concluded that true cause of deterioration is mechanical, determining factors being frictional rub of water and impinging on propeller blades of water broken with evacuated spaces which subsequently collapse on propeller blades. Formation of erosion-resisting alloy.

Manufacture. The Manufacture of High-Class Marine Propellers. Eng. Production, vol. 2, no. 20, Feb. 17, 1921, pp. 227-236, 15 figs. Procedure at Charlton Works of J. B. Stone & Co., England. Paper read before Inst. of Mar. Engrs.

PULLEYS

Standard. Standard Belt Pulley, Chris Nyberg. Agricultural Eng., vol. 2, no. 1, Jan. 1921, p. 21, 1 fig. Chart for solution of pulley-spoke dimensions.

Standardization of Diameters. Standardization of Pulley Diameters (Normung der Riemenscheibendurchmesser), Ludwig Gück. Werkstattstechnik, vol. 15, no. 4, Feb. 15, 1921, pp. 87-90. Standardization of diameters based on standardized speeds which are presented in tabular form.

PULVERIZED COAL

Uses. A Series of Discourses on Use of Powdered Anthracite and Recovery and Use of River Coal, George H. Ashley, C. W. Webbert, Jonathan P. Edwards, G. R. Delamater, W. S. Guigley, Richard H. Vail, J. R. Wyllie, J. H. Kennedy, W. W. Pettibone and H. D. Savage. Jl. Engrs. Club of Phila., vol. 38, no. 194, Feb. 1921, pp. 39-63, 8 figs. Statements by geological and mining authorities and engineers on best methods of pulverizing anthracite coal, together with results of boiler fires made at pulverized fuel plant at Lykens, Pa.

PUMPS

Humphrey. The Humphrey Pump Engr., vol. 131, no. 340, Mar. 4, 1921, pp. 237 and 238, 4 figs. Installation of Humphrey pumps for Metropolitan Water Board at Chingford. Record of efficiency tests.

Lubricator for. A New Pump Lubricator. Engr., vol. 131, no. 3398, Feb. 11, 1921, p. 161, 2 figs. Prevention of airlock in oil passages when starting up is feature.

PUMPS, CENTRIFUGAL

Gasoline-Engine Drive. Gasoline-Engine Drive for Centrifugal Pumps, T. M. Heermans. Power, vol. 53, no. 10, Mar. 8, 1921, pp. 376-377, 5 figs. Types of engines used. Curves show that engine horsepower should be 25 per cent greater than water horsepower required.

PYROMETERS

Platinum-Resistance. Notes Regarding the Construction of Platinum Resistance Thermometers and Immersion Heating Coils of Low Lag, T. S. Sligh. Jl. Am. Chem. Soc., vol. 43, no. 3, Mar. 1921, pp. 470-475, 2 figs. Studies at Bur. of Standards with a view to increasing accuracy and simplify construction of platinum-resistance thermometers.

QUAY WALLS

Anchored. Experimental Study of the Stability of Anchored Quays (Etude expérimentale de la stabilité des quais avec ancrages), M. Ravier. Mémoires et compte rendu des travaux de la Société des ingénieurs civiles de France, vol. 73, nos. 7, 8 and 9, July-Sept. 1920, pp. 471-481, 11 figs. Economical advantages of anchoring quay walls.

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RADIOMETALLOGRAPHY

Examining Materials. X-Ray Examination of Materials, J. R. Clarke. Beama, vol. 8, no. 2, Feb. 1921, pp. 125-132. Experience obtained in research department of Metropolitan-Vickers Electrical Co., England.

RAILS

Manufacture. Steel Rails, C. W. Gennet, Jr. Jl. Western Soc. Engrs., vol. 26, no. 3, Mar. 1921, pp. 77-85. Comparative study of various processes for manufacturing steel rails.

Sink-Head Ingots. Steel Rails from Sink-Head and Ordinary Rail Ingots, Geo. K. Burgess. Dept. of Commerce, Technologic Papers of Bur. of Standards, no. 178, Dec. 15, 1920, 61 pp., 23 figs. Results obtained in experiments indicated decided superiority of sink-head ingots over ordinary ingots as made of three grade of steel.

RAILWAY ELECTRIFICATION

Chicago. The Illinois Central Electrification Project, Elec. Traction, vol. 17, no. 1, Jan. 1921, pp. 1-5, 4 figs. Ordinance regarding electrification of Chicago Terminals of Illinois Central Railroad was passed by Chicago city council July 21, 1919, and accepted by Illinois Central Railroad Co., Feb. 20, 1920. Details of project.

Europe. Electrification in Central Europe, E. C. Zehme. Elec. Ry. Jl., vol. 57, no. 10, Mar. 5, 1921, pp. 438-440. Résumé of conditions in Germany, Sweden, Norway, Holland and Italy.

Status of Foreign Electrification, E. C. Zehme. Elec. World, vol. 77, no. 10, Mar. 5, 1921, pp. 527-529. Developments in Germany, Austria, Sweden, Norway, Holland, Switzerland and Italy.

Sweden. The Electrification of the Swedish State Railways (L'électrification des chemins de fer de l'état suédois), M. Marchand. Industrie Electrique, vol. 30, no. 688, Feb. 25, 1921, pp. 68-72. Technical comparison of direct-current system with single-phase alternating-current system. Conditions in Sweden.

RAILWAY OPERATION

Economics. Report of Committee XXI—On Economics of Railway Operation. Bul. Am. Ry. Eng. Assn., vol. 22, no. 234, Feb. 1921, pp. 723-791, 13 figs. Methods for increasing efficiency of employees by furnishing them with reports and comparisons planned to inform and interest all concerned. Methods for increasing traffic capacity of railway, including analyses of costs and study of effect of speed of trains upon cost of operation.

RAILWAY REPAIR SHOPS

Design. A New Type of Erecting Aisle Saves Shop Headroom. Ry. Age, vol. 70, no. 9, Mar. 4, 1921, pp. 521-522, 3 figs. "Gap crane" erecting shop by which from 15 to 18 ft. of vertical height of shop building is saved.

RAILWAY TIES

Life. Tie Renewals in Relation to Average Life. Technical Note no. 130, Forest Products Laboratory, U.S. Forest Service, 2 pp., 1 fig. Comparisons of 43 groups included 42,000 ties of many species, some untreated and some treated.

Pneumatic Tamping. Determining the Cost of Pneumatic Tie Tamping. Ry. Maintenance Engr., vol. 17, no. 3, Mar. 1921, pp. 105-106. Records of tests conducted by Delaware, Lackawanna & Western Railroad.

Standards. Standard Specifications for Ties. Ry. Rev., vol. 68, no. 9, Feb. 26, 1921, pp. 327-328. Specifications adopted by Nat. Assn. of Railroad Tie Producers, Jan. 18, 1921.

RAILWAY TRACK

Construction. Another Chart for Estimating Track Materials, C. E. Pfifer. Ry. Maintenance Engr., vol. 17, no. 3, Mar. 1921, pp. 102-103, 1 fig. Standard track construction practices of Union Pacific Railroad.

Committee V—on Track. Bul. Am. Ry. Eng. Assn., vol. 22, no. 234, Feb. 1921, pp. 649-693, 20 figs. Typical plans of turnouts, crossovers, slip switches, double crossovers, and railroad crossings. Specifications for track tools.

Roadway. Report Committee I—Roadway. Bul. Am. Ry. Eng. Assn., vol. 22, no. 234, Feb. 1921, pp. 695-722, 8 figs. Methods of determining extent, character and effect of subsidence under embankments. Specifications for corrugated metal culverts in railway work.

Subsidence of Earth Fills. Methods of Investigating Subsidence Under Railway Fills. Eng. News-Rec., vol. 86, no. 10, Mar. 10, 1921, pp. 437-438, 2 figs. Particulars as to apparatus, methods and costs compiled from reports submitted by individual railways to Railroad Presidents' Conference Committee on federal valuation.

RESEARCH

Industrial. Industrial Research. Iron Age, vol. 107, no. 10, Mar. 10, 1921, p. 638. Program being carried out by Engineering Foundation. Industrial research on nation-wide scale, in which engineering organizations, universities, factories, individuals and private laboratories and other organizations are co-operating is under way. From annual report of Engineering Foundation.

The origin and Development of the Research Associations Established by the Department for Scientific and Industrial Research, A. Abbott. Jl. Royal Soc. of Arts, vol. 69, no. 3561, Feb. 18, 1921, pp. 181-205. Department has so far approved and licensed 23 industrial associations.

RETAINING WALLS

Concrete. Curved Retaining Wall of the Cantilever Type, Charles E. Parry. Concrete, vol. 18, no. 3, Mar. 1921, pp. 126-128, 8 figs. Reinforced-concrete structure.

ROAD CONSTRUCTION

Conference on Highway Engineering. Education for Highway Engineering and Highway Transport, F. L. Bishop and Walton C. John. Dept. of Interior, Bur. of Education, bul. no. 42, 1920, 134 pp. Report of conference on highway engineering and highway transport education, held in Washington, May 14 and 15, 1920, under direction of Commissioner of Education, with reports of preliminary meetings.

Cost System. The Analysis and Preparation of Estimates for Road Construction, H. J. Kuelling. Public Roads, vol. 3, no. 33, Jan. 1921, pp. 32-36. Cost system forms used by Wisconsin State Highway Commission.

Illinois Experimental Highway. The Illinois Experimental Highway, Chas. C. Brown. Public Works, vol. 50, no. 8, Feb. 19, 1921, pp. 166-168, 2 figs. Road, which is two miles long, is divided into 64 different sections, each of which differs in some respect from all the others. Concrete, brick and bituminous concrete welding surfaces are included in nearly equal lengths.

Rural. The Relative Service Value of Different Types of Rural Pavements, A. R. Hirst. Public Roads, vol. 3, no. 33, Jan. 1921, pp. 24-32. Suggestions in regard to selection of certain type under given set of conditions.

Traffic Census. The Traffic Census. Eng. & Contracting, vol. 55, no. 9, Mar. 2, 1921, pp. 202-204. Suggested tally sheet for traffic census.

ROADS, CONCRETE

Bituminous Foundations. Bituminous Foundations for Pavements, Hugh W. Skidmore. Mun. & County Eng., vol. 60, no. 2, Feb. 1921, pp. 55-60, 3 figs. Advantages of Bituminous foundation for concrete roads. Records of service of roads thus constructed.

Construction. Present Methods of Concrete Road Construction. Am. City, vol. 24, no. 3, Mar. 1921, pp. 233-237, 5 figs. Equipment used in construction of concrete roads.

Progress in the Use of Concrete for Highway Work. Contract Rec., vol. 35, no. 8, Feb. 23, 1921, pp. 181-183, 2 figs. More extended use of mechanical equipment. Developments in grading aggregates.

The Construction of the Toronto-Hamilton Highway, H. S. VanScoyoc. Jl. the Eng. Inst. of Canada, vol. 4, no. 3, Mar. 1921, pp. 159-176, 14 figs. Account of construction of pre-cast slab concrete road, with data on costs.

ROLLING MILLS

Universal-Plate. New Universal-Plate Mill, J. H. Moore. Can. Machy., vol. 25, no. 9, Mar. 3, 1921, pp. 65-69, 7 figs. Installation of Dominion Foundries & Steel, Ltd., at Hamilton, Ont. Mill will roll universal-plate from 7 in. to 41 in., shear plate to 64 in., and will also roll slabs and billets.

ROOFS

Sawtooth. A New Type of Saw-Tooth Construction. Manufacturers Rec., 79, no. 10, Mar. 10, 1921, pp. 95-96, 3 figs. Super-span construction devised by Ballinger Co., Phila.

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SAFETY

Bureau of Mines Schedules. Permissible Schedules Issued by the Bureau of Mines, L. C. Ilsley. Reports of Investigations, Bur. of Mines, Dept. of Interior, Feb. 1921, serial no. 2211, 3 pp. List of active schedules available to manufacturers. Schedules establish minimum standards for safety, and details of test methods in manufacture of explosives, electric motors, safety lamps, mine-rescue, apparatus, storage-battery locomotives, etc.

SANDING MACHINES

Economical Speeds. Determine Economical Sanding Speeds, James F. Adams. Abrasive Industry, vol. 2, no. 2, Feb. 1921, pp. 52-53, 2 figs. Curves constructed from results of sanding tests.

SCHOOLS

Industrial. A University in an Industry, Edwin Kurtz. Indus. Management, vol. 61, no. 5, Mar. 1, 1921, pp. 191-193. Mutual university conducted by 6500 employees of Milwaukee Elec. Ry. & Light Co.

SCIENTIFIC MANAGEMENT

See Industrial Management.

SCREW MACHINES

Automatic. Magazine Feeds for Automatic Screw Machines. Machy. (N. Y.), vol. 27, no. 7, Mar. 1921, pp. 617-622, 10 figs. Equipments developed by Cleveland Automatic Machine Co., for handling second-operation work.

Straight Forming Tools. Dimension of Straight Forming Tools. Machy. (N.Y.), vol. 27, no. 6, Feb. 1921, pp. 560-564, 1 fig. Table giving depth of steps on straight forming tools measured at right angles to front face, corresponding to various differences between radii on work.

SEMI-DIESEL ENGINES

Air Admission. New Type of Mechanism for Air Admission in Semi-Diesel Motor (Nouveau type de commande d'admission d'air dans les moteurs semi-Diesel). Génie Civil, vol. 78, no. 7, Feb. 12, 1921, pp. 160, 1 fig. Rotary valve controls admission of air into cylinder in semi-Diesel engine manufactured by Ansald San Giorgio Corp.

SEMI-STEEL

Cast Iron vs. Cast-Iron vs. Semi-Steel, Ernest Wheeler. Foundry Trade Jl., vol. 23, no. 233, Feb. 3, 1921, pp. 99-100. Als. Eng. & Indus. Management, vol. 5, no. 8, Feb. 24, 1921, pp. 234-236. Tables are given showing results of tensile, physical, chemical and foundry tests of semi-steel and ordinary cylinder iron.

Tests. What is Semi-Steel? H. Field. Foundry Trade Jl., vol. 23, no. 237, Mar. 3, 1921, pp. 201-204. Records of chemical and physical tests. Paper read before Birmingham Branch, Instn. British Foundrymen.

SEWAGE DISPOSAL

London. City of London Sewerage and Sewage Disposal, H. S. Philips. Can. Engr., vol. 40, no. 11, Mar. 17, 1921, pp. 297-301, 6 figs. Comprehensive scheme now being formulated. Combined system for majority of areas requiring new or relief sewers. Basis of calculations. Relation of sewage disposal to sanitation and riverfront improvements. Sewerage and town planning.

SHEARS

Large High-Speed. Six-Foot High-Speed Shearing Machine. Engineering, vol. 111, no. 2880, Mar. 11, 1921, pp. 286-288, 7 figs. Driven by electric motor carried on bracket bolted to side frame, through cut gearing and treadle running whole length of front of machine.

SHIP CONSTRUCTION

Anglesmithing. Modern Anglesmithing, Maurice Nicholls. Mar. Eng., vol. 26, no. 2, Feb. 1921, pp. 135-137, 9 figs. Arrangement of angle shop. Typical methods of making inside and outside bends by means of welding apparatus.

SHIP DESIGN

Hulls. The Problem of the Hull and Its Screw Propeller, C. W. Dyson. Jl. Am. Soc. Naval Engrs., vol. 33, no. 1, Feb. 1921, pp. 98-147, 24 figs. Notes on design of hull and propeller. Paper read before Soc. Naval Architects & Mar. Engrs.

SHIP PROPULSION

Hydraulic. The Hydraulic Propulsion of Ships. Engr., vol. 131, nos. 3398-3399, Feb. 11 and 18, 1921, pp. 140-142, 3 figs., and 172-194, 3 figs. Feb. 11: Hotchkiss hydraulic propulsion system applied to steel launch measuring 24 ft. in length overall and 6 ft. 3 in. in beam molded and having draught of 1 ft. 5 in. on displacement of 2 tons. Essential feature of system is creation of vortex that travels along with vessel. Feb. 18: Gill system, in which propulsive reaction of discharge stream is transmitted to hull through rollers mounted on vertical spindles.

SHIPS

Cargo. To Compute Cargo Space. Mar. Eng., vol. 26, no. 3, Mar. 1921, p. 211. Formula for computing hold space required for shipment of barrels, worked out by U. S. Bur. of Standards.

Gyrostabilizer. The Effect of Bilge Keels and a Gyrostabilizer, Wm. McEntee. Engineering, vol. 111, no. 2877, Feb. 18, 1921, pp. 208-210, 17 figs. Comparative tests of bilge keels and a gyrostabiliser on a model of the United States aircraft carrier Langley. Paper read before Soc. of Naval Architects and Mar. Engrs.

Loading and Unloading. The Mechanical Loading of Ships, H. J. Smith. Jl. Instn. Mech. Engrs., no. 1, Feb. 1921, pp. 67-96. Developments in mechanical systems of loading coal and ore into ships.

SIGNALLING

Selsyn System. The Selsyn System of Position Indication, E. M. Hewlett. Gen. Elec. Rev., vol. 24, no. 3, Mar. 1921, pp. 210-218, 16 figs. System consists of special transmitting generator electrically connected to similar receiving motor. Typical installations are described, notably those at locks at Panama Canal and similar equipment to be placed in operation at locks of New Orleans Industrial Canal. Further applications of system are visualized.

SILICA BRICK

Structural Changes. Structural Changes in Silica Bricks. Foundry Trade Jl., vol. 23, no. 235, Feb. 17, 1921, pp. 152-154. Results of analyses of used roof bricks from both acid and basic furnaces.

SMOKE PREVENTION

Salt Lake Valley. Swain's Report on Smoke in Salt Lake Valley. Chem. & Metallurgical Eng., vol. 24, no. 11, Mar. 16, 1921, pp. 463-465. Summary of field conditions surrounding Murray and Midvale smelters and resulting effect on plant and human life. Notes on operating conditions giving immunity damage and difficulties in stipulating maintenance without hampering progress.

SPRINGS

Helical. Chart and Simplified Formulae for Helical Torsion Springs of Tempered Steel. Machy. (Lond.), vol. 17, no. 440, Mar. 3, 1921, p. 677, 1 fig. Dimensions and deflections for tempered steel torsion springs for maximum carrying capacity.

STANDARDS

German N. D. I. Report. Report of the German Industry Committee on Standards (Mitteilungen des Normenausschusses der Deutschen Industrie). Betrieb, vol. 3, no. 8, Jan. 25, 1921, pp. 109-125, 18 figs. Approved standards for Whitworth and metric threads. Proposals of Board of Directors for round drawn copper, aluminum, brass and zinc wires and rods; precision round drawn steel and iron rods and wires. Proposed new standards for flat drive, sunk and gib-head keys.

STEAM

Flow in Pipes. Chart for Determining Flow of Steam in Pipes, Ernest Owen. Power Plant Eng., vol. 25, no. 5, Mar. 1, 1921, pp. 269-270, 1 fig. Chart showing flow of steam in pipes.

STEAM-ELECTRIC PLANTS

England. West Bank Dock Electric Generating Station. Engr., vol. 131, no. 3398, Feb. 11, 1921, pp. 148-150 and 152, 9 figs. Steam-electric plant at bank of River Mersey, supplying power to alkali works in and around Widnes. Total capacity will be 20,000 kw. obtained from turbo sets of 5000 kw. each.

Inspection. Checking Efficiency of Generating Plants, John O. Fuchs. Elec. World, vol. 77, no. 10, Mar. 5, 1921, pp. 530-533, 6 figs. Inspection practice at plant of United Hudson Electric Corporation, Poughkeepsie, N. Y. Daily records which amount to 24-hour efficiency tests are kept for all units in the generating station.

STEAM ENGINES

Michell Crankless. The Michell Crankless Steam Engine. Engineering, vol. 111, no. 2880, Mar. 11, 1921, pp. 290-291, 5 figs. Engine works on uniflow principle. It comprises 8 cylinders, each 5 in. in diameter arranged four on each side of swash plate which is keyed to driving shaft of engine.

STEAM POWER PLANTS

Ford Plant. New Ford Plant Power House at River Rouge. Power, vol. 53, no. 9, Mar. 1, 1921, pp. 332-335, 3 figs. Consolidated blast furnace, steel mill, foundry and manufacturing plant. Double-ended boilers 83 ft. high, having 26,470 sq. ft. of steam-making surface, are arranged to burn blast-furnace gas and powdered coal.

Location. The Location of an Industrial Power Plant, M. K. Bryan and A. S. Wells. Power, vol. 53, no. 10, Mar. 8, 1921, pp. 387-389, 4 figs. Importance of far-sighted planning for possible future developments is emphasized and typical examples of plants are quoted in which lack of space was cause of many troubles in operation and costly modifications in plant and equipment.

Maintenance. Maintenance-Department Methods—I. Keeping the Power-Plant Records, Hubert E. Collins. Power, vol. 53, no. 11, Mar. 15, 1921, pp. 418-421, 3 figs. Forms for keeping records.

STEAM TURBINES

Governors. The Governing of Steam Turbines, J. P. Chittenden. English Elec. Jl., vol. 1, no. 5, Jan. 1921, pp. 178-189, 15 figs. Principle of centrifugal governor, and its application to steam turbines.

Pressure Distribution. Pressure Distribution in Steam Turbines, Gerald Stoney. Engineering, vol. 111, no. 2879, Mar. 4, 1921, pp. 250-252, 1 fig. Formulas and graph.

Reversing. A Description of a New Reversing Turbine. Power House, vol. 14, no. 4, Feb. 20, 1921, pp. 37-38 and 40. 3 figs. Patented device.

STEEL

Case-Hardening. *See Case-Hardening.*

Copper in. Copper in Steel and the Corrosion of Cars, A. R. Surface. Sci. Am., vol. 124, no. 10, Mar. 5, 1921, p. 185, 1 fig. Service records of cars having both copper-bearing and plain steel plates. After six years of service copper steel plates showed practically no corrosion while plain steel plates were severely corroded.

Defects in. Defects in Steel and Their Detection, J. H. Andrew. Jl. West of Scotland Iron & Steel Inst., vol. 28, part 3, Dec. 1920, pp. 28-31 and (discussion) pp. 31-35, 8 figs. on 4 supp. plates. Applications of micro-examination, macro printing, thermal curves, dilatation determinations, resistivity measurements and magnetic testing.

Fatigue Tests. Fatigue Breakdown in Automobile Steels, John Miller. Trans. Am. Soc. for Steel Treating, vol. 1, no. 6, Mar. 1921, pp. 321-325, 2 figs. Method of making fatigue tests.

Magnetic Behavior. The Magnetic Behavior of Iron in Alternating Fields of Frequencies Between 100,000 and 1,500,000 Cycles, Leon T. Wilson. Proc. Inst. Radio Engrs., vol. 9, no. 1, Feb. 1921, pp. 56-77, 11 figs. Mild-steel ribbon, 0.002 inch in thickness was tested at various radio frequencies between 100,000 and 1,500,000 cycles per second for relation between ampere turns per centimeter and flux density, and for core loss in watts per cubic centimeter at various frequencies.

Molybdenum. *See Molybdenum Steel.*

Nickel. *See Nickel Steel.*

Rolling. Application in Rolling of Effects of Carbon, Phosphorous, and Manganese on Mechanical Properties of Steel, Wm. R. Webster. Min. & Metallurgy, no. 171, Mar. 1921, pp. 49-50. Critical summary of results found by various investigators. (Abstract.)

Specifications. Exporting Iron and Steel—VII, V. G. Iden. Iron Trade Rev., vol. 68, no. 10, Mar. 10, 1921, pp. 698-703. Iron and steel specifications in foreign countries.

Structural. *See Structural Steel.*

STEEL CASTINGS

Manufacture. The Manufacture of Steel Castings, D. D. MacGuffie. Foundry Trade Jl., vol. 23, no. 237, Mar. 3, 1921, pp. 197-200, 6 figs. Process at Tropenas works, England. Paper read before Sheffield & Lond. Branches, Instn. British Foundrymen.

STEEL, HEAT TREATMENT OF

Automobile Crankshafts. Heat-Treatment of Low-Carbon Steel Automobile Crankshafts. Franklin D. Jones. Machy. (N. Y.), vol. 27, no. 6, Feb. 1921, pp. 521-523, 4 figs. Practice of H. H. Franklin Mfg. Co., Syracuse, N. Y., in heat treatment of crankshafts, including copper, plating, carburizing, and hardening operations.

Successive Treatments. The Dimensional Limitation of Successive Heat-Treatments of Carbon Steel, W. P. Wood. Chem. & Metallurgical Eng., vol. 24, no. 8, Feb. 23, 1921, pp. 345-346, 2 figs. Experimental records of change in length after rapid heat treatment. Hypo-eutectoid steel shrank more rapidly than others.

Tempering of. The Tempering of Steel (La tempra degli acciai), N. Parravano. Industria, vol. 35, no. 2, Jan. 31, 1921, pp. 26-33, 26 figs. Experimental study at Istituto Chimico della R. Universita, Rome, to determine nature of transformation which takes place during tempering of steel. Interpretation of photomicrographs.

STEEL, HIGH-SPEED

Hardening. A Note on Double Preheating High-Speed Tools for Hardening, A. E. MacFarland. Trans. Am. Soc. for Steel Treating, vol. 1, no. 6, Mar. 1921, pp. 306-309. Practice of hardening high-speed steel tools using double preheating treatment. Advantages to be derived from double preheating operation.

STEEL MANUFACTURE

Basic Slag. Influence of the Basicity of Thomas Slag on the Operating Results of a Converter (Einfuss der Basiitäzt der Thomasschlacke auf die Betriebsergebnisse des Konverters), L. Blum. Stahl u. Eisen, vol. 41, no. 3, Jan. 20, 1921, pp. 69-74. From analyses it is shown that the Thomas process operates most economically, both with regard to even dephosphorization and small consumption of manganese and to high degree of desulphurization and reduced waste, when the excess of lime calculated according to given formula amounts to about 4 per cent.

Electric-Furnace. Electric Furnaces for Making Steel—I, Alfred Stansfield. Blast Furnace & Steel Plant, vol. 9, no. 3, Mar. 1921, pp. 189-193, 7 figs. Classification of electric steel-making furnaces. General features and advantages of arc furnace and resistance furnace. Operating features of electric furnaces.

STEEL WORKS

Basic Open-Hearth Melting Shop. Basic Open-Hearth Melting Shop Equipment and Practice, G. A. V. Russell. Iron & Coal Trades Rev., vol. 111, no. 2764, Feb. 18, 1921, pp. 238-239, 2 figs. Basic open-hearth melting shop for output of 7000 tons of ingots per week. (Concluded.) Paper read before Swindon Eng. Soc.

Eight-Hour Shift. Eight-Hour Shift in British Steel Plants, Whiting Williams. Iron Age, vol. 107, no. 10, Mar. 10, 1921, pp. 635-638. Eight-hour shift has resulted in increased production and better feeling.

Weirton, W. Va. Enters Ranks of Steel Manufacturers, C. H. Hunt. Iron Trade Rev., vol. 68, no. 10, Mar. 10, 1921, pp. 685-691, 7 figs. Open-hearth and rolling mills of Weirton Steel Co., West Va.

New Steel Plant of the Weirton Steel Co. Iron Age, vol. 107, no. 10, Mar. 10, 1921, pp. 619-627, 9 figs. Plant includes blast furnace, open-hearth furnaces and mills for producing sheet bars, billets and slabs. Attention is called to labour-saving equipment installed. (To be concluded.)

The Plants of the Weirton Steel Company, C. H. Hunt. Blast Furnace & Steel Plant, vol. 9, no. 3, Mar. 1921, pp. 233-246, 12 figs. Description of steel plant, including blast furnace, open-hearth furnaces and mills for producing sheet bars, billets and slabs.

STREET CLEANING

Sweepers. Some Observations and Facts Concerning Motor Sweepers, John T. Child. Public Works, vol. 50, no. 8, Feb. 19, 1921, pp. 159-162. Details of construction and operation of different makes. Conditions under which use of motor sweepers is financially advisable.

STRESSES

Elongation and Shear. Comparison of Theories of Elongation and of Shear Stress. Mech. Eng., vol. 43, no. 3, Mar. 1921, pp. 193-194, 7 figs. Comparison of methods proposed for determination of stresses. Translated from Zeitschrift des Vereines deutscher Ingenieure.

Structural Members. Stresses in Structural Members and the Limitations of Material Testing (Spannungen in Konstruktionskörpern und Grenzen der Materialprüfung), O. Lasche. Betrieb, vol. 3, no. 8, Jan. 25, 1921, pp. 197-206, 30 figs. Discussion of examples of fabrication, bearing, load and peat stresses. Address presented before German Metallurgical Soc.

STRUCTURAL STEEL

Standard Sections. French Standard Sections. Bulletin technique du Bureau Veritas, vol. 3, no. 2, Feb. 1921, pp. 39-42, 14 figs. List of scantlings which have been adopted by French Standardization Committee appointed by French Government in June 1918. List includes all scantlings which are of general use and also those used in certain industries such as shipbuilding, mines, etc.

SUPERPOWER SURVEY

See Central Stations, Superpower.

T

TANK CARS

Reinforced-Concrete. Reinforced Concrete Tank Cars (Wagons-réservoirs en ciment armé), Marcel Demouy. Outillage, vol. 105, no. 6, Feb. 10, 1921 pp. 177-178, 3 figs. Type developed at Delauncy-Belleville car works.

TELEGRAPHY

Railways. Some Phases of Railroad Telegraph and Telephone Engineering, Stanley Rhoads. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 3, Mar. 1921, pp. 224-232, 13 figs. Description of New York Central lines telegraph and telephone plant and variety of engineering problems involved. Automatic telephones are used almost exclusively for train dispatching and to a certain extent for message work. (To be continued.)

TERMINALS, LOCOMOTIVE

Design. Report of Committee XXIII—On Shops and Locomotive Terminals. Bul. Am. Ry. Eng. Assn., vol. 22, no. 233, Jan. 1921, pp. 585-647, 75 figs. Typical layout for storage and distribution of fuel oil, including fuel oil stations between terminals. Design of enginehouses and power plants, store houses, car shops and coaling stations.

TERMINALS, MARINE

Design. Marine Terminals, J. A. Jackson. Gen. Elec. Rev., vol. 24, no. 3, Mar. 1921, pp. 234-237, 1 fig. Design factors to be considered to bring about economical efficiency of marine terminals.

TESTING MACHINES

Ball-Hardness. A Small Ball-Hardness Testing-Machine, H. Moore. Jl. Instn. Mech. Engrs., no. 1, Feb. 1921, pp. 51-61, 7 figs. Machine developed for hardness testing of carriage cases. Load of 3000 kg. is applied through ball of 10 mm. diameter.

Developments. Recent Developments in Testing Machines, Thorsten Y. Olsen. Forging & Heat Treating, vol. 7, no. 2, Feb. 1921, pp. 131-134, 22 figs. Impact tension, impact shear, repeated impact, toughness and endurance, alternate torsion and transverse testing machines. Paper read before Am. Soc. for Steel Treating.

Torsion Strain Meter. A New Torsion Strain Meter, E. H. Lamb. Engineering, vol. 111, no. 2880, Mar. 11, 1921, pp. 279-280, 7 figs. Each of ends of bars is attached to one of two brass tubes which slide freely one within the other. Slide twist of bar is measured by determination of relative motions of two plain mirrors, each fixed on one of brass tubes.

THERMIT WELDING

Wrought-Iron Pipe. An Unusual Case of Thermit Pipe Welding, Edward A. Miller. Power, vol. 53, no. 9, Mar. 1, 1921, pp. 351-352, 8 figs. Experience in welding wrought-iron pipe.

TIDAL POWER

Severn Barrage Scheme. Severn Barrage Scheme. Engr., vol. 131, nos. 3400-3401, Feb. 25 and Mar. 4, 1921, pp. 210-211 and 230-231. Account of joint meeting held by Instns. of Civil Engrs., Elec. Engrs. and Mech. Engrs. to discuss Severn barrage scheme for utilization of tidal power on Severn, and particularly third interim report of Water Power Resources Committee of making a plan for utilization of such power by means of a dam across estuary and a high-level reservoir a certain distance up the river.

TIME STUDY

Group of Machines. How to Make Group Time Studies, Philip Bernstein. Indus. Management, vol. 61, no. 5, Mar. 1, 1921, pp. 187-189, 4 figs. Method of setting rates when a number of machines are operated by one man.

TIRES, RUBBER

Substitutes. Substitutes for Rubber Tires, H. Jahr. India Rubber World, vol. 63, no. 6, Mar. 1, 1921, pp. 417-421, 42 figs. In writer's belief, solids or semi-solids made of an infinite variety of compounds may be successfully used. Notes on fiber, cord, felt, hair, paper and cardboard, and asphalt tires. Translated from "Kunststoffe".

TOLERANCES

Determining. Tolerances in Mechanical Construction (Les "tolérances" dans la construction mécanique), C. Reinewald. Génie Civil, vol. 78, no. 6, Feb. 5, 1921, pp. 130-132, 7 figs. System of determining manufacturing tolerances.

TOWN PLANNING

Pittsburg District. Regional Planning in the Pittsburgh District, Morris Knowles and Maurice R. Scharff. Proc. Engrs. Soc. Western Pennsylvania, vol. 36, no. 10, Jan. 1921, pp. 683-726 and (discussion) pp. 727-733, 7 figs. Developments and present status of town planning in Pittsburgh Metropolitan District.

TRACTOR ENGINES

Drilling Operations. Methods in a Tractor Engine Plant. Machy. (N. Y.), vol. 27, no. 6, Feb. 1921, pp. 516-518, 4 figs. Battery of drilling machines arranged for continuous operation.

Manufacture. Methods in a Tractor Engine Plant. Machy. (Lond.), vol. 17, no. 440, Mar. 3, 1921, pp. 665-668, 8 figs. Machining cylinder liners on rotary type of boring machine.

TRAFFIC

Census. The Traffic Census, A. N. Johnson. Public Roads, vol. 3, no. 32, Dec. 1920, pp. 16-28. Summary of traffic censuses that have been made in other countries and various states. Method of taking census.

TRANSPORTATION

Conditions in U. S. Phases of The Transportation Problem, Francis W. Davis, Frank T. Hines, Gustav Lindenthal and J. R. Bibbins. Mech. Eng., vol. 43, no. 3, Mar. 1921, pp. 181-183. Discussion on motor-truck transportation, government operation of inland waterways, and proposed plan for handling New York City's freight and passenger traffic. Abstracts of some of papers presented and discussion held at Transportation Session of annual meeting, Am. Soc. Mech. Engrs.

TUBES

Seamless, Manufacture. On the Manufacture of Seamless Tubes—I, Ing. Karl Gruber. Blast Furnace & Steel Plant, vol. 9, no. 3, Mar. 1921, p. 312. Mannesmann oblique rolling process.

V

VENTILATION

Ventilators. Some Comparative Tests of Sixteen-Inch Roof Ventilators, H. L. Dryden, W. F. Stutz and R. H. Heald. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 27, no. 2, Mar. 1921, pp. 93-100, 4 figs. Tests made at Bur. of Standards to determine comparative performance of rotary and stationary, and mushroom and siphon ventilators.

VIBRATIONS

Machinery. A Comparative Study of Vibration Absorbers, H. C. Howard. Jl. Indus. & Eng. Chem., vol 13, no. 3, Mar. 1921, pp. 231-235, 6 figs. Apparatus for making comparative measurements of vibrations. Results of measurements of vibrations absorbed by various devices. Suggested arrangement of rubber balls for absorbing vibrations.

VISCOSIMETERS

See Oil Fuel, Specifications.

VOCATIONAL TRAINING

Disabled Men. Training the Disabled. Eng. Production, vol. 2, no. 23, Mar. 10, 1921, pp. 315-318, 6 figs. British Government instructional factory at Twickenham.

W

WAGES

Bonus Systems. Bonuses for Quality as Well as Quantity, A. A. Blue. Iron Age, vol. 107, no. 11, Mar. 17, 1921, pp. 687-689, 2 figs. Employees on heat-treating department, Duff Mfg. Co., Pittsburgh, must keep temperatures within limits to get extra pay.

Premium Wage Plan in Milwaukee Shops, J. H. Lucas. Elec. Ry. Jl., vol. 57, no. 12, Mar. 19, 1921, pp. 528-532, 5 figs. Résumé of six years' experience with bonus pay for standardized jobs. System is now applied to 50 per cent of total time worked.

WATER GAS

Possibilities as Industrial Fuel. Water-Gas, A. E. Blake. Proc. Engrs., Soc. of Western Pa., vol. 36, no. 9, Dec. 1920, pp. 575-597 and (discussion) pp. 598-510, 10 figs. Possibilities of water gas as industrial fuel in U. S.

WATER HAMMER

Conduits. Water Hammer in Conduits (Les coups de bélier dans les conduits d'eau), M. Camichel. Mémoires et Compte rendu des Travaux de la Société des Ingénieurs civils de France, vol. 73, nos. 7, 8 and 9, July-Sept. 1920, pp. 482-512, 24 figs. Calculation of stresses developed.

Penstocks. Calculation of Water Hammer in the Penstock of a High Reaction Turbine (Calcul du coup de bélier dans une conduite alimentant une turbine à forte réaction), M. de Sparre. Comptes rendus des Séances de l'Académie des Sciences, vol. 172, no. 8, Feb. 21, 1921, pp. 425-427. Formulas for computing stresses developed.

WATER POWER

California. Half Million Horsepower from Pit River. A. H. Markwart. Elec. World, vol. 77, no. 11, Mar. 12, 1921, pp. 581-584, 9 figs. Contemplated developments exceeding 450,000 kva. in northern California. First station now under construction. Line being built for 220,000 volts.

WELDING

Steel Castings. Fragility Incurred at "Blue Heat" In Welds of Steel Castings (De la fragilité au bleu dans certaines soudures d'aciers), Charles Frémont. Comptes rendus des Séances de l'Académie des Sciences, vol. 172, no. 7, Feb. 14, 1921, pp. 368-370, 3 figs. Experiments showed that weaknesses ordinarily developed in steel castings at critical temperatures between 200 and 450 deg. cent. could be overcome by eliminating during welding operation all oxidized metal from ends being welded.

See also Electric Welding; Thermit Welding.

WELDS

Testing. Standardization in the Testing of Welds, F. M. Farmer. Engr., vol. 131, no. 3400, Feb. 25, 1921, pp. 200-202, 4 figs. Three standards are suggested—shop standards, commercial standards and research standards. Paper read before Instn. Mech. Engrs.

The Desirability of Standardization in the Testing of Welds, F. M. Farmer. Engineering, vol. 111, no. 2878, Feb. 25, 1921, pp. 239-242, 7 figs. Paper read before Instn. Mech. Engrs.

WELFARE WORK

Bathhouses. What H. C. Frick Coke Co.'s Experience Shows to be the Best Type of Bathhouse, D. J. Baker. Coal Age, vol. 19, no. 8, Feb. 24, 1921, pp. 349-354, 6 figs. Clothes are hoisted into bottomless lockerettes keeping clothes apart. Water kept thermostatically at 110 deg. fahr. Separation of rooms prevents splashing of water on men dressing. No locks used on clothes chains.

Medical Attention. Emergency Procedure in Shop Accidents. Metal Trades, vol. 12, no. 3, Mar. 1921, pp. 98-100. From miscellaneous bulletins of U. S. public Health Service.

How to Treat Skin Affections of Employees, Walter C. Allen. Indus. Management, vol. 61, no. 5, Mar. 1, 1921, pp. 180-181. Bulletin sent out by Ohio State Board of Health.

Mining Camps. Recreation in the Modern Mining Community, Eng. & Min. Jl., vol. 111, no. 9, Feb. 26, 1921, pp. 379-381, 3 figs. Clubhouse of International Nickel Co. at Copper Cliff, Ontario.

WIRE ROPE

Manufacture. The Manufacture of Wire Rope, Carl King. Blast Furnace & Steel Plant, vol. 9, no. 3, Mar. 1921, pp. 196-197, 13 figs. General description of machines and operations involved in manufacture of wire rope at Palmer plant of Wickwire Spencer Steel Corp.

WOOD PRESERVATION

Treatment. Report of Committee XVII—Wood Preservation. Bul. Am. Ry. Eng. Assn., vol. 22, no. 233, Jan. 1921, pp. 442-479, 3 figs. Experimental investigation of comparative efficiencies of various treatments.

WORKMEN'S COMPENSATION

Employers' Liabilities. Liability for Lack of Ventilation, Chesla C. Sherlock. Am. Mach., vol. 54, no. 9, Mar. 3, 1921, pp. 374-376. Scope of common and statutory laws. Liability under compensation acts. Effects of safety appliance laws, or factory acts.

Social Insurance and. Workmen's Compensation and Social Insurance, Carl Hookstadt. Monthly Labor Rev., vol. 12, no. 2, Feb. 1921, pp. 154-164. Cost of occupational diseases under workmen's compensation acts in U. S.

Engineering Index

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A

ACCIDENT PREVENTION

Coal Mines. State Regulations on Accident Prevention Covering Electric Circuit in Coal Mines, L. C. Ilsley and R. A. Kearns. Report of Investigations, Bur. of Mines, Dept. of Interior, no. 2224, Mar. 1921, 7 pp. Abstracts from mining laws of 15 states.

ACCIDENTS

Dust Explosions. Dust Explosions: Cause, Effect and Prevention, David J. Price. Eng. News Rec., vol. 86, no. 15, April 14, 1921, pp. 634-636, 6 figs. Ignition and propagation of flame. Changes in construction to prevent high pressures from being built up within heavy concrete wall construction.

AEROPLANE ENGINES

Constant-Compression. Aeroplane Engines Injecting Constant Mass of Fuel and Effecting Constant Compression at all Altitudes (Moteur d'aviation admettant une masse constante et effectuant une compression constante à toute altitude), M. A. Witz. Comptes rendus des Séances de l'Académie des Sciences, vol. 172, no. 11, Mar. 14, 1921, pp. 641-644. Possibilities of such motor for flight at high altitudes.

Developments. Army and Navy Development of Aero Engines. Aviation, vol. 10, no. 13, Mar. 28, 1921, pp. 390-391, 1 fig. Types of engines approved by Secretary of War and Secretary of Navy for development of army and navy air services.

Supercharging. The Calculated Performance of Airplanes Equipped with Supercharging Engines, E. C. Kemble. Nat. Advisory Committee for Aeronautics, report no. 101, 1921, 52 pp., 26 figs. Theoretical discussion of performance of aeroplane as affected by use of supercharging engine, together with comparative study of respective merits of different types of superchargers.

AEROPLANES

Classification. Naming and Classifying Airplanes. Aviation, vol. 10, no. 13, Mar. 28, 1921, pp. 391. System adopted by Engineering Division of U. S. Army Air Service.

Design. The Factors That Determine the Minimum Speed fo an Aeroplane, F. H. Norton. Aerial Age, vol. 13, no. 3, Mar. 28, 1921, pp. 57-60, 6 figs. It is computed that wing section affects minimum speed 26 per cent; aspect ratio, 4 per cent; gap chord ratio, 4 per cent; longitudinal control, 20 per cent; lateral control, 15 per cent; power in level flight, 5 per cent; vertical component of air screw thrust, 3 per cent; stagger, 2 per cent; scale, 2 per cent; and slipstream on wings, 1 per cent.

German. German Aerial Developments, Erik Hildesheim. Aeronautics, vol. 20, no. 388, Mar. 24, 1921, pp. 198-200, 4 figs. Survey of types of aeroplanes under construction in German aircraft works.

Helicopters. *See Helicopters*

Military. Recent Progress in Military Aviation, H. S. Martin. Jl. Soc. Automotive Engrs., vol. 8, no. 4, April 1921, pp. 335-338, 7 figs. Military aeroplanes recently developed by U. S. Army Air Service.

Stability. Aeroplane Stability. Times Eng. Supp., no. 557, Mar. 1921, p. 102. Methods of longitudinal equilibrium.
See also Aviation, Soaring Flight.

AIR LIFT

See Pumps, Air-Lift.

AIRCRAFT

Design. Some Practical Points in the Structural Design of Aircrafts, A. P. Thurston. Engineering, vol. 121, no. 2881, Mar. 18, 1921, pp. 335-337, 8 figs. Also in Flight, vol. 13, no. 11, Mar. 17, 1921, pp. 194-197, 8 figs. Determination of maximum loads under various conditions of loading. Paper read before Instn. Aeronautical Engrgs.

AIRCRAFT CONSTRUCTION MATERIALS

Fabrics. Airship Fabrics, J. W. W. Dyer. Aeronautics, vol. 20, nos. 387, 388 and 389, Mar. 17, 24 and 31, 1921, pp. 182-183, 200-202 and 225-226. Tensile properties and resistance to tearing. Bursting tests on larger models. Strength under sustained load. Methods of production. Fabrics for rigid airships.

AIR COMPRESSORS

Regulation, Automatic. Automatic Regulation of Compressors (Selbsttätige Regelung von Kompressoren), Robert Nitzschmann. Feuerungstechnik, vol. 9, no. 9, Feb. 1, 1921, pp. 74-75, 3 figs. Arrangement for remote control from compressed-air plant.

ALCOHOL

Industrial. Raw Materials for Industrial Alcohol Production, Chas. F. Juritz. So. African Jl. of Industries, vol. 4, no. 2, Feb. 1921, pp. 167-175. Yields from sugar-beet, prickly-pear fruit, molasses, potatoes, sweet potatoes, maize, acorus, prickly-pear leafstems, straw and sawdust.

Recovery from Coke-Oven Gas. Alcohol from Coke Oven Gas, Cecil F. Tidman. Colliery Guard-Mian, vol. 121, no. 3141, Mar. 1921, p. 713. Also Iron & Coal Trades Rev., vol. 102, no. 2767, Mar. 11, 1921, p. 350. Experiments at Skinningrove Works, England. Paper read before joint meeting of Soc. Chem. Industry & Cleveland Instn. Engrs.
See also Automobile Fuels, Alcohol.

AMMONIA COMPRESSORS

Rod Packing. Ammonia Compressor-Rod Packing, W. H. Motz. Power, vol. 53, no. 14, April 5, 1921, pp. 543-545, 4 figs. Comparative value of different types of packing.

APPRENTICES, TRAINING OF

Machine Industry. Training Men for the Machine Industry, Erik Oberg. Machy. (N.Y.), vol. 27, no. 8, April 1921, pp. 779-782, 6 figs. Organization of educational and training departments established by Norton Co., Worcester, Mass., with view to qualifying men for various classes of occupations in machine industry.

National Apprenticeship Council. Apprenticeship Plan Drawn Up by Joint Conference Board. Contract Rec., vol. 35, no. 14, April 6, 1921, pp. 336-339. Formation of National Apprenticeship Council governing local councils is suggested. Apprenticeship agreement enforces employers to provide time for education along technical lines.

ASHES

Weight of Conical Pile. The Weight of a Conical Pile of Ashes, N. G. Near. Power Plant Eng., vol. 25, no. 8, April 15, 1921, p. 418, 1 fig. Chart giving weight of conical pile of ashes.

ASPHALT

Refining. Asphalt Production, Refining and Related Problems, Herbert Spencer. Can. Engr., vol. 40, no. 13, Mar. 31, 1921, pp. 343-347, 8 figs. Plant and methods of Standard Oil Co. of New Jersey. Paper read before Am. Soc. for Mun. Improvements.

AUTOMOBILE ENGINES

Assembling. Methods of Motor Assembly. Am. Mach., vol. 54, no. 15, April 14, 1921, pp. 641-645, 14 figs. Practice in assembling of Essex motor.

High-Speed. High-Speed Engines of Small Piston Displacement, Louis Chevrolet and C. W. Van Ranst. Jl. Soc. Automotive Engrgs., vol. 8, no. 4, April 1921, pp 368-374, 8 figs. Racing engine designed by Frontenac Motor Co., Indianapolis.

Starters. Instantaneous Current and Voltage Values in Battery, G. W. Vinal and C. L. Snyder. Jl. Soc. Automotive Engrs., vol. 8, no. 4, April 1921, pp. 319-327 and 364, 17 figs. Experiments conducted at Bur. of Standards to determine effects of temperature, compression, lubrication, distributor action and flywheel velocity upon operation on starter system.

AUTOMOBILE FUELS

Alcohol. Forest Products as Motor Fuels, E. C. Scherrard. Sci. Lubrication, vol. 1, no. 2, Feb. 1921, pp. 8-13 and 25. Possibilities of ethyl alcohol as substitute for gasoline or as auxiliary for blending purposes.

Progress in Tests of Alcohol as Fuel. Power Wagon, no. 197, April 1921, p. 20. Report of British Empire Motor Fuels Committee.

The Carburetion of Alcohol, A. W. Scarratt. Jl. Soc. Automotive Engrs., vol. 8, no. 4, April 1921, pp. 328-330, 2 figs. Characteristics curves of four-cylinder engine equipped with special hotspot manifold for burning alcohol.

Benzol. Benzol for Motor Fuel. Gas & Oil Power, vol. 16, no. 186, Mar. 3, 1921, p. 84. Specifications of British Eng. Standards Assn. Benzol is defined as mixture of benzene and not more than 30 per cent by volume of toluene and xylenes.

Kerosene. Utilization of Kerosene as Automobile Fuel (L'emploi des pétroles lampants dans les moteurs d'automobiles), A. Grebel. Génie Civil, vol. 78, no. 14, April 2, 1921, pp. 289-295. Technical study of carburetion of kerosene and account of experiments conducted at Schneider works in France.

Palm Oil. Palm Oil as Engine Fuel. Gas & Oil Power, vol. 16, no. 186, Mar. 3, 1921, pp. 85-86. Tests in Brussels with palm oil and other vegetable oils grown in Belgian Congo.

Research. Motor Fuel. So. African Eng., vol. 32, no. 3, Mar. 31, 1921, pp. 55-56. Research on utilization of gasoline substitute as automobile fuels. Report of Empire Motor Fuels Committee of Imperial Motor Transport Council.

Semi-Water Gas. Utilization of Water Gas as Automobile Fuel (Utilisation du gas pauvre à l'alimentation des moteurs d'automobiles), E.-H. Lemonon. Nature (Paris), no. 2445, Feb. 12, 1921, pp. 105-112, 10 figs. Records of experiments. Apparatus used for operating Ford car by means of gas.

AUTOMOBILES

Carburetors. *See Carburetors.*

Clutch and Gear-Box Design. Developments in Transmission, S. Bramley-Moore. Jl. Soc. Automotive Engrs., vol. 8, no. 4, April 1921, pp. 350-364, 25 figs. Developments in clutch and gear box design which have been suggested with a view to reducing cost of upkeep.

Drive Gears. Gears for Motor Transmissions, Fred H. Colvin. Am. Mach., vol. 54, no. 14, April 7, 1921, pp. 606-609, 14 figs. Machining and assembling operations.

Research. Much Useful Automotive Research in Progress at Bureau of Standards, Herbert Chase. Automotive Industries, vol. 44, no. 14, April 7, 1921, pp. 750-755, 7 figs. Work now proceeding includes tests of brake linings made with view to standardizing apparatus for this purpose, efficiency and endurance tests of truck axles, study of flame propagation and detonation phenomena, and test of lubricants intended to determine definitely what physical characteristics render oil best suited for use in automotive engines.

Transmission Units. Methods Used by Transmission Specialists, Fred H. Colvin. Am. Mach., vol. 54, no. 13, Mar. 31, 1921, pp. 537-540, 12 figs. Frame-case and bell-case types of transmission. Machining operations on two types. Special tools, fixtures and methods for economical production.

AVIATION

Canadian Air Progress — 1920. Aviation, vol. 10, no. 12, Mar. 21, 1921, pp. 372-375.

Commercial Future of Aviation (L'avenir commercial de l'aviation), M. Maurice Duval. Ingénieur, vol. 36, no. 11, Mar. 12, 1921, pp. 199-203. Economical advantage of aerial transportation.

B

BEAMS

Buckling of. Flexural Buckling, Albert E. Guy. Army Ordnance, vol. 1, no. 5, March-April 1921, pp. 256-261, 15 figs. Laws of buckling of cantilever beams on uniform rectangular sections.

Reinforced-Concrete. Determining Proportions of Reinforced T-Beams. Eng. World, vol. 18, no. 4, April 1921, pp. 279-280, 1 fig. Graph for computing proportions.

Effect of Repeated Reversals of Stress on Double-Reinforced Concrete Beams, W. A. Slater, G. A. Smith and H. P. Mueller. U. S. Dept. of Commerce, Technologic Papers, Bur. of Standards, no. 182, Dec. 20, 1921, 51 pp., 33 figs. For all of beams tested failure was by tension in steel. Generally beams in which highest stresses were developed in test withstood smaller number of repetitions of load than those in which measured stresses were smaller.

Torsion on Rectangular Cross-Sections, C. R. Young. Can. Engr., vol. 40, no. 12, Mar. 24, 1921, pp. 315-318, 2 figs. Formulas for determining stresses in beams of rectangular section. Method of reinforcing concrete beams for torsion.

Standard Sections, British. Eccentricity Factors for British Standard Sections, G. D. Balsille. Commonwealth Engr., vol. 8, no. 6, Jan. 1, 1921, pp. 176-180, 5 figs. Tables computed from formulas given in Makers' Handbook.

BEARINGS, BALL

Lubrication. Requirements for Ball Bearing Lubrication, J. B. Castino. Sci. Lubrication, vol. 1, no. 2, Feb. 1921, pp. 18-19 and 31, 4 figs. Specifications for greases and oils.

BENZOL

Uses. Benzole—Its Recovery, Rectification, and Uses. Gas Jl., vol. 153, no. 3008, Jan. 5, 1921, pp. 31-33. Review of book by S. E. Whitehead published by Benn. Bros., London.

See also Automobile Fuels, Benzol.

BLAST-FURNACE GAS

Dust Recovery. Blast Furnace Flue Dust Recovery, George B. Cramp. Iron Age, vol. 107, no. 12, Mar. 24, 1921, pp. 775-778, 1 fig. Automatic apparatus for wet recovery of flue dust.

Handling Flue Dust Economically, George B. Cramp. Iron Trade Rev., vol. 68, no. 12, Mar. 24. 1921, pp. 836-839, 1 fig. Plan for recovery of blast-furnace flue dust and charging it in form of sludge into top of stack.

BLASTING

Shaft Sinking. Blasting in Tunnels and Shaft Sinking, W. L. Scanlan. Coal Industry, vol. 4, no. 4, April 1921. pp. 203-206, 2 figs. Methods employed in anthracite region, where heavy pitch of coal necessitates constant rock work and every detail must be studied with cost in mind.

BOILER INSPECTION

National Board of Boiler Inspectors. Constitution and By-Laws of National Board of Boiler Inspectors. Boiler Maker, vol. 21, no. 4, April 1921, pp. 107-109. Object of association is to promote uniformity of construction and inspection of boilers in U. S.

Regulations. Regulations for Inspection of Railway Steam Boilers, other than Locomotive Boilers. Can. Ry. & Mar. World, no. 278, April 1921, p. 179. General order passed on Feb. 16, 1921, by Board of Ry. Commissioners for Canada.

BOILER OPERATION

Combustion. Heating Value in Connection with Steam-Boiler Investigations (Der Heizwert bei Dampfkesseluntersuchungen), H. Hilliger. Zeit. des Vereines deutscher Ingenieure, vol. 65, no. 11, Mar. 12, 1921, pp. 270-272, 4 figs. Notes on quantity of saturated vapor in combustion gases; importance of the separation of water from the combustion gases for operation and boiler efficiency; consideration of higher heating value in tests.

Instruments. Boiler Operation at the Power Plant of the Mesta Machine Company, C. Fisher. Blast Furnace & Steel Plant, vol. 9. no. 4, April 1921, pp. 239-247, 9 figs. Installation of mechanical devices and instruments.

BOILERS

Heat Transmission. Tests on Heat Transmission in Steam Boilers (Considération sur la transmission de la chaleur dans les générateurs de vapeur déduites d'essais de vaporisation), Victor Kammerer. Bulletin de la Société Industrielle de Mulhouse, vol. 86, no. 8, Nov. 1920, pp. 519-582, 10 figs. Experiments on water-tube boiler. Emperical equations are constructed from results found.

Marine. *See Marine Boilers.*

BOILERS, WATER-TUBE

Marine. Advantages of the Use of the Water-Tube Boiler in the Mercantile Marine, James Kemnal. Trans. North-East Coast Instn. Engrs. & Shipbuilders, vol. 37, part 4, Feb. 1921, pp. 185-192 and (discussion), pp. 193-208, 8 figs., partly on 3 supp. plates. Chief advantages claimed for water-tube boiler over cylindrical boiler are greater safety, possibility of using higher pressures and saving in weight.

BRAKES

Train, Tests. Handling 9,000 Tons Down a 1.6 per cent Grade. Ry. Rev., vol. 68, no. 14, April 2, 1921, pp. 515-521, 9 figs. Tests conducted by Norfolk & Western on control of 70-car train with automatic straight air-brakes.

BRICK

Sand-Lime. Sand-Lime Brick—Description and Specification. Dept. of Commerce, Circular, Bur. of Standards, no. 109, Jan. 3, 1921, 9 pp. 2 figs. Manufacturing process with properties on brick. Standard specifications for building brick.

BRIDGE DESIGN

Pins Formulas. Higher Stresses for Bridge Pins, D. B. Steinman. Eng. News-Rec., vol. 86, no. 12, Mar. 24, 1921, pp. 502-503, 3 figs. Tests of iron and steel pins show usual flexure theory inapplicable. Formulas for practical use.

BRIDGE PIERS

Construction. Construction Features of Black St. Bridge Piers, Hamilton, Ont. Eng. & Contracting, vol. 55, no. 12 Mar. 23, 1921, pp. 280-282, 4 figs. Excavation of pier foundations in open by means of dragline excavators.

BRIDGES, CONCRETE

Arch. Redesign of Belle Isle Bridge to Reduce Cost, H. H. Esselstyn and William H. Adams. Eng. News-Rec., vol. 86, no. 11, Mar 17, 1921, pp. 452-455, 8 figs. Arch structure proposed because bids on adopted cantilever design exceed available fund. Arch type held liable to injury from settlement of pile foundations in clay.

Ontario, Canada. Construction of Ashburnham Bridge, Peterboro. Can. Engr., vol. 40, no. 14, April 7, 1921, pp. 355-358, 3 figs. Eleven arches, totalling 1172 ft. in length, connect residential section with business district. Shiploft used to obtain perfect ellipses.

Reconstruction. Repair of Tempe Concrete Arch Bridge Damaged by Settlement and Floor Expansion, Merrill Butler. Eng. News-Rec., vol. 86, no. 16, April 21, 1921, pp. 675-679, 6 figs. Bridge over Salt River endangered by failure of cylinder pier supposed to rest on rock. Load transferred to new cylinders sunk alongside pier. Cracking of floor and spandrels. Expansion joints.

BRIDGES, HIGHWAY

Roughness Impact. Analysis of Roughness Impact on Highway Bridges, Willis Whited. Eng. News-Rec., vol. 86, no. 14, April 7, 1921, pp. 582-583, 1 fig. Floor irregularities principal source of impact. Formula derived from study of motion of wheel when striking obstacle indicates increase of two-thirds load for three-inch roughness.

Impact Under High-Speed Traffic on Highway Bridges, W. D. Uhler. Eng. News-Rec., vol. 86, no. 14, April 7, 1921, pp. 583-584. Addition of twenty per cent of four-wheel load found sufficient to allow for maximum roughness of floor.

BRIDGES, RAILWAY

Inspection. Present Wages and Rules Ruining Canadian Railways, J. L. Payne. Ry. Age, vol. 70, no. 12, Mar. 25, 1921, pp. 789-792, 3 figs. Systematic investigations of railway bridges with a view to determining maximum load which they can safely carry.

BROACHES

Burnishing. Burnishing Broaches, E. A. Dixie. Am. Mach., vol. 54, no. 14, April 7, 1921, pp. 599-601, 8 figs. How to make and use broaches. Kinds of spoiled work that may be reclaimed by their use. Turning broached work with diamond.

BROACHING

Keyways. Guide Bushings for Keyway Broaching, Carl H. Briggs. Machy. (N.Y.), vol. 27, no. 8, April 1921, pp. 767-769, 4 figs. Formulas for designing bushings for broaching accurate keyways

BUILDING CONSTRUCTION

Electric Welding in. Electrically-Welded Structural Steelwork. Engineering, vol. 121, no. 2881, Mar. 18, 1921, pp. 323, 3 figs. Welding used for extension of foundry building.

BUILDINGS

Manitoba Parliament Building. Manitoba Parliament Building is an Imposing Structure. Contract Rec., vol. 35, no. 15, April 13, 1921, pp. 365-371, 6 figs. Engineering and architectural details.

BULKHEADS

Deflections. Notes on Deflections of Bulkheads and of Ships, A. M. Robb. Engineering, vol. 111, no. 2883, April 1, 1921, pp. 407-410, 21 figs. Application of theory of beamsto investigation of bulkhead stiffening. Paper read before Instn. Naval Architects.

Spacing. On the Spacing of Transverse Bulkheads, K. G. Finlay. Engineering, vol. 111, no. 2883, April 1, 1921, pp. 403-405, 6 figs. Scheme for determining subdivisions of bulkheads. Paper read before Instn. Naval Architects.

BUSES

London. Motor Omnibus for the London General Omnibus Company, Limited. Engineering, vol. 111, no. 2883, April 1, 1921, pp. 391-392, 9 figs. partly on supp. plate. Double deck buses with total seating capacity of 54 passengers.

C

CABLES, ELECTRIC

Aluminum. Underground Feeder Cables (Cable souterrains d'alimentation). Rapport de M. L. Sekutowicz. Industrie des Tramways et Chemins de Fer, vol. 14, no. 3, 157-158, Jan.-Feb. 1920, pp. 3-11, 21 figs. Technical requirements of armored cables. Utilisation of aluminum as conductor. Statistics giving life of underground cables

CAMS

Design. Calculation of Inertia Forces in Mechanisms Operated by Cams (Calcul des effort d'inertie dans les mécanismes commandés par des cames), P. Cayére. Arts et Métiers, vol. 71, no. 4, Jan. 1921, pp. 28-30, 6 figs. Construction of acceleration graphs for typical mechanisms.

Manufacture. Production of Accurate Cams, E. A. Dixie. Am. Mach., vol 54, no. 13, Mar. 31, 1921, pp. 553-556, 15 figs. Fixtures employed in manufacture of typical cams.

CAR AXLES

Manufacture. The Manufacture of Railway Axles Ry. Engr., vol. 42, no. 494, Mar. 1921, pp. 85-87, 4 figs. Special machinery and equipment developed by British manufacturers.

CAR DUMPERS

Grain-Elevator Type. Car Dumpers for Quick Unloading at Grain Elevator. Eng. News-Rec., vol. 86, no. 12, Mar. 24, 1921, pp. 508-509, 3 figs. Car-dumper units combining automatic device for opening grain doors.

CAR WHEELS

Chilled Iron. Manufacture, Properties and Uses of Chilled Iron Wheels (Les roues en fonte trempée, leur fabrication, propriétés et usages), M. E. Polushkin. Revue de Métallurgie, vol. 18, no. 1, Jan. 1921, pp. 143-57, 10 figs. Heat treating process. Interpretation of photomicrographs. Bibliography. (Concluded.)

CARBURETORS

Manifolds, Vaporizing in. Vaporizing in the Manifold, Robert W. A. Brewer. Autocar, vol. 46, no. 1324, Mar. 5, 1921, pp. 429-431, 7 figs. Study of conditions of carburetion and of correct methods of insuring vaporization of fuel.

CARS, FREIGHT

Container System. Container System Extended on the New York Central. Ry. Rev., vol. 68, no. 16, April 16, 1921, pp. 600-602, 4 figs. Container system was first operated for express car and is now being extended to freight service.

Draft-Gear Tests. Draft-Gear Tests of the Railroad Administration. Ry. Mech. Engr., vol. 95, no. 4, April 1921, pp. 229-232, 4 figs. Investigations conducted by inspection and test section of Baltimore & Ohio Railroad.

Gondola. New Norfolk & Western 100-Ton Coal Cars, John A. Pilcher. Ry. Age, vol. 70, no. 15, April 15, 1921, pp. 923-928, 9 figs. Body supported on side bearings instead of center plate. New type six-wheel truck.

CARS, PASSENGER

Steel. Safety of Passengers in Steel Cars, Frank M. Brinkerhoff. Official Proc. New York Railroad Club, vol. 31, no. 5, Mar. 18, 1921, pp. 6399-6413 and (discussion) pp. 6413-6433, 12 figs. Suggests protection of steel cars with special arrangement of cable loops at ends, to prevent telescoping in accidents.

CAST IRON

Filtering. The Filtering of Cast Iron (Le filtrage de la fonte), D. Mathu. Fonderie Moderne, no. 1, Jan. 1921, pp. 9-16, 15 figs. Brunelli process for filtering cast iron by pouring it through special funnel which removes impurities.

Nickel, Influence on. Influence of Nickel on Cast Iron. Automotive Industries, vol. 44, no. 13, Mar. 31, 1921, p. 705. Results of tests on cast iron with nickel and cobalt additions. Addition of one per cent nickel increased compressive and transverse strength 30 per cent while tensile strength increased 25 per cent and hardness 18 per cent. Effect of cobalt is reserve of that of nickel, except in respect to hardness.

CASTINGS

Centrifugal. Centrifugal Castings. Engineering, vol. 121, no. 2881, Mar. 18, 1921, pp. 311-312, 6 figs. Methods and machines employed for casting cylindrical articles under centrifugal pressure at works of Stokes Castings, Ltd., Mansfield, England.

Cleaning. Cleaning and Dressing Castings, F. W. Wilson. Foundry Trade Jl., vol. 23, no. 239, Mar. 17, 1921, pp. 243-246, 4 figs. Cleaning chamber for intricate castings. Paper read before Manchester Assn. Engrs.

Cleaning and Dressing Castings—II, F. W. Wilson. Machy. (Lond.), vol. 18, no. 443, Mar. 24, 1921, pp. 775-777, 4 figs. Details of sand-blasting apparatus.

CEMENT

Analysis. Chemical Analyses of Cement as Indicators of Behavior. Eng. News-Rec., vol. 86, no. 15, April 14, 1921, pp. 637-639, 2 figs. Rearrangement of stock analyses recommended so as to show true content of active agents.

Slabs. New Design Date for Cement Slabs. Am. Architect, vol. 119, no. 2359, Mar. 9, 1921, pp. 287-291, 10 figs. Tests at Lehigh University on slabs poured with mixture under pressure from nozzle.

CEMENT GUN

Uses. The Application of Cement Mixtures by Machinery, George J. Young. Eng. & Min. Jl., vol. 111, no. 13, Mar. 26, 1921, pp. 537-543, 6 figs. Summary of properties and examples of use of gunite in mining and metallurgical industry. Fireproofing of underground timber and surface structures. Prevention of slabbing by sealing rock surfaces and obviating action by air and moisture.

CEMENT, PORTLAND

Testing. Japanese Standard Rules for Testing Portland Cement. Eng. World, vol. 18, no. 4, April 1921, pp. 273-274. Issued by Dept. of Agriculture and Commerce on Feb. 10, 1905, revised Dec. 10, 1909, and June 20, 1919. Translated by Japan Portland Cement Assn.

Portland Cement, R. F. Stradling. Concrete & Constructional Eng., vol. 16, no. 3, Mar. 1921, pp. 169-177, 13 figs. Comparative study of British and foreign standards and methods of testing portland cement. (To be concluded.)

CENTRAL STATIONS

Electric-Furnace Operation. Electric Furnaces and Central Station Charges, H. O. Swoboda. Forging & Heat Treating, vol. 7, no. 3, Mar. 1921, pp. 190-193, 3 figs. Curves illustrating decrease of cost of electric energy with increasing load factor for various maximum demands. Comparison of electric-station load in industrial districts with and without electric furnace.

CENTRAL STATIONS

Mine-Mouth. A Mine-Mouth Super-Power Station. Power, vol. 53, no. 14, April 5, 1921, pp. 532-542, 22 figs. Total capacity is to be 300,000 kw., in units of 60,000 kw. Power is generated at 12,000 volts and is stepped up to 66,000 volts through bank of three 23,600-kva. transformers in power house. Station is located near coal mine about 50 miles from Pittsburgh.

CHAINS

Anchor. New Method for Manufacture of Anchor Chain, Hubert Hermanns. Forging & Heat Treating, vol. 7, no. 3, Mar. 1921, pp. 156-158, 3 figs. German method of rolling chain from flat strip of wrought iron. Scarf weld is eliminated, making stronger and more uniform anchor chain.

CHARCOAL

Manufacture. The Production of Artificially Dense Charcoal, L. F. Hawley. Jl. Indus. & Eng. Chem., vol. 13, no. 4, April 1921, pp. 301-302, 1 fig. Report for distillation of briquets under mechanical pressure.

CHIMNEYS

Heights. A New Method for Proportioning Chimney Heights, Robert Sibley and C. H. Delany. Jl. Electricity & Western Industry, vol. 46, no. 6, Mar. 15, 1921, pp. 299-300, 1 fig. Diagram showing available draft at chimney base for various rates of gas flow and chimney diameters. Rule for determining altitude.

CHROMIUM STEEL

Chromium-Constant. Recent Work on Chromium: Tungsten Steel—Method of Magnetic Analysis. Chem. & Metallurgical Eng., vol. 24, no. 13, Mar. 30, 1921, pp. 573-575, 3 figs. Review of literature of chromium-constant steels, specially work of Japanese investigators. First of series of articles.

Microstructure. Microstructure of Chromium Steels. Chem. & Metallurgical Eng., vol. 24, no. 16, April 20, 1921, pp. 703-706, 16 figs. Brief review of literature, especially from Japanese investigator Murakami, presenting structural diagram, photomicrographs and explanation of changes in transformation temperature following various reheatings.

CHUCKS

Drill. Application of Interchangeability to Drill Chuck Manufacture. Machy. (Lond.), vol. 17, no. 441, Mar. 10, 1921, pp. 693-699, 9 figs. Tooling and gaging equipment in manufacture Casler twinscrew drill chuck.

Magnetic. Magnetic Chucks—V, Ellsworth Sheldon. Am. Mach., vol. 54, nos. 14 and 15, April 7 and 14, 1921, pp. 602-605, 9 figs., and 650-652, 7 figs. Chucks manufactured by Blanchard Machine Co.

COAL

Carbonization. The Assay of Coal for Carbonization Purposes, Thomas Gray and James G. King. Colliery Guardian, vol. 121, no. 3141, Mar. 11, 1921, pp. 716-717, 2 figs. Laboratory method. Technical paper of British Fuel Research Board.

Coking Capacity. The Better Utilization of Coking Slack, A. E. Beet and A. E. Findley. Trans. Instn. Min. Engrs., vol. 60, part 3, Feb. 1921, pp. 213-221, 2 figs. Means of preventing types of coal from going to coking plant which cannot be rendered by washing low enough in sulphur and ash to give coke suitable for metallurgical purposes. Method of utilizing these coals to best advantage.

Research. Fuel Research Bureau Advocated to Solve Problems of Scientific Use and Handling of Coal, F. R. Wadleigh. Coal Age, vol. 19, no. 13, Mar. 31, 1921, pp. 581-583. Lancashire and Cheshire (England) coal research association, suggested as model, resembles U. S. war research board, but is broader in scope. Has coal-testing plant and laboratory and also makes commercial investigations. Plan for American commission outlined.

Spontaneous Combustion. Causes of Spontaneous Combustion in Coal and Method of Treatment of Underground Fires, K. Neville Moss. Iron & Coal Trades Rev., vol. 102, no. 2769, Mar. 25, 1921, pp. 425-426, 3 figs. Effect of presence of iron pyrites in connection with underground fires.

COAL DEPOSITS

Vancouver Island. The Submarine Coal-Field of Nanaimo, Vancouver Island, B.C. Can. Min. Jl., vol. 42, no. 12, Mar. 25, 1921, pp. 228-230, 1 fig. Characteristics of deposits and method of working them.

COAL DUST

Combating Dangers of. Mine Dust: Sampling, Testing and Treatment, W. H. McMillan. Iron & Coal Trades Rev., vol. 102, no. 2767, Mar. 11, 1921, pp. 345-346. Methods of combating dangers arising from accumulations of coal dust, with reference to regulations recently enacted by British Government. Paper read before South Midland Branch, Nat. Assn. Colliery Managers.

Problem of. Methods of Dealing with Coal-Dust, A. L. Lovatt. Trans. Instn. Min. Engrs., vol. 60, part 3, Feb. 1921, pp. 311-323 and (discussion) pp. 323-335, 14 figs. partly on 2 supp. plates. Organization and equipment for dealing with coal dust at Birchenwood Collieries.

COAL FIELDS

Alaska. A Report on the Alaskan Coal Fields, George Watkins Evans. Coal Industry, vol. 4, no. 4, April 1921, pp. 224-227. General description of four principal fields in Alaska. Coal is not of as high a grade as is generally believed. Paper read before Am. Inst. Min. & Metallurgical Engrs.

COAL GAS

Blending. The Composition of Coal Gas in Relation to its Utilization, R. V. Wheeler. Gas Jl., vol. 153, no. 3017, Mar. 9, 1921, pp. 615-619, 4 figs. Blending of coal gas with coke-oven gas and water gas. Paper read before Sheffield Gas Consumers' Assn.

COAL MINES

Legislation on Use of Electricity. State Regulations on the Use of Electricity in Coal Mines Increasing, L. C. Ilsley. Elec. World, vol. 77, no. 14, April 2, 1921, pp. 763-765. Type of regulations governing use of electrical equipment in coal mines.

COAL MINING

Pillar Drawing. Coal Pillar Drawing Methods in Europe, George S. Rice. Coal Industry, vol. 4, no. 4, April 1921, pp. 215-218, 5 figs. Discussion of pillar and single stall, pillar and double stall, square chamber, and bord and pillar methods as used in Europe to-day. Paper read before Am. Inst. Min. & Metallurgical Engrs.

COAL WASHING

Froth Flotation. Froth Flotation as Applied to the Washing of Industrial Coal, Ernest Bury, Walter Broadbridge and Alfred Hutchinson. Trans. Instn. Min. Engrs., vol. 60, part 3, Feb. 1921, pp. 243-253, 4 figs. Principles of froth flotation and account of operation of froth-flotation process. Representative results obtained on various types of material. Economical aspects of process specially as applied to preparation of coal for production of metallurgical coke.

COKE

Testing. Standardizes the Testing of Coke. Iron Trade Rev., vol. 68, no. 15, April 14, 1921, pp. 1037-1038, 2 figs. Committee report of Southern Ohio Pig Iron Assn.

CONCRETE CONSTRUCTION, REINFORCED

Cost of Placing Concrete. What is the Best Arrangement for a Contractor's Plant? Contract Rec., vol. 35, no. 13, Mar. 30, 1921, pp. 312-315, 8 figs. Analytical treatment of cost of placing concrete in reinforced concrete buildings, using various layouts of plant. Chart comparing seven types of plant layout.

COMPRESSED AIR

Metering. The Metering of Compressed Air, John L. Hodgson. Trans. Instn. Min. Engrs., vol. 60, part 3, Feb. 1921, pp. 271-280 and (discussion) pp. 280-287, 17 figs. Construction and operation of various types fo meters.

Expansion and Contraction. Expansion and Contraction in Concrete Structures, Albert M. Wolf. Eng. World, vol. 18, no. 4, April 1921, pp. 233-236, 1 fig. Experimental results found by various investigators. Derivation of empirical formula for determining net contraction of concrete.

Proportioning. Proportioning Concrete on Job by Exact Methods, R. B. Young and T. V. McCarthy. Eng. News-Rec., vol. 86, no. 11, Mar. 17, 1921, pp. 456-458, 2 figs. Method developed by Hydro-electric Power Commission of Ontario.

CONCRETE BLOCKS

Casting. The Calculation of Concrete Blocks (Note sur le calcul des pièces en béton de ciment fondu), A. V. Magny. Revue de l'Ingénieur, vol. 28, no. 3, Mar. 1921, pp. 125-130, 3 figs. Tests on blocks. Formulas for designing.

Tests. Quality Concrete Products. Concrete Products, vol. 20, no. 3, Mar. 1921, pp. 45-46 and 51-52. Results of tests on concrete block, brick and hollow concrete building tile. Specifications adopted by Am. Concrete Inst. for concrete block, brick, tile and architectural trim stone.

CONCRETE, REINFORCED

Reinforcing Steel. Tests on High Tension Steels in Reinforced Concrete Design, H. Kempton Dyson. Concrete & Constructional Eng., vol. 16, no. 3, Mar. 1921, pp. 161-168, 1 fig. Report of special committee on high tension steel in reinforced concrete of British Concrete Inst.

COPPER

Tests. Experiments on Copper Crusher Cylinder, Alexander I. Krynitsky. Dept. of Commerce, Technologic Papers, Bur. of Standards, no. 185, Feb. 1, 1921, 32 pp., 15 figs. Compression tests on standard Riehlé testing machine. Length of cylinders decreased considerably under repeated application of load.

COPPER ALLOYS

Copper-Nickel. Copper-Nickel Alloys, Paul D. Merica. Chem. & Metallurgical Eng., vol. 24, no. 13, Mar. 30, 1921, pp. 558-560, 4 figs. Notes on structure and properties of alloys used for driving bands, condenser tubes and coinage. Various names and analyses for nickel silver are tabulated, with notes upon their most common uses.

Copper-Tin. The Constitution of the Alloys of Copper with Tin, III, John L. Haughton. Metal Industry, (Lond.), vol. 18, no. 13, April 1, 1921, pp. 241-247, 7 figs. Transformations other than formation of eutectic, occurring below 250 deg. cent. Range of composition studied was from about 40 per cent tin to 100 per cent tin.

Heat Treatment. Heat Treatment of Copper Alloys, J. S. Glen Primrose. Foundry Trade Jl., vol. 23, no. 241, Mar. 31, 1921, pp. 291-296, 10 figs. Experimental study of effect of heat-treatment upon tensile properties of copper-aluminum and copper-zinc alloys. Paper read before Instn. British Foundrymen.

Properties. Plastic Deformation of Some Copper Alloys at Elevated Temperatures, C. A. Edwards and A. M. Herbert. Engineering, vol. 121 no. 2881, Mar. 18, 1921, pp. 341-344, 11 figs. Also in Metal Industry (Lond.), vol. 18, no. 12, Mar. 25, 1921, pp. 221-229, 11 figs. Apparatus designed by writers for making identation tests under dynamic stresses. Results of experiments with copper-zinc and copper-aluminum alloys. Paper read before Inst. of Metals.

CORROSION

Boiler Tubes. Unusual Boiler Tube Corrosion by Carbon Dioxide, Barzillai G. Worth. Am. Electro-chemical Soc., Thirty-Ninth Gen. Meeting, April 21-23, 1921, no. 28, pp. 329-335, 2 figs. Corrosion was located as due to soluble iron bicarbonate in water used, which gave off large quantities of carbonic acid gas when heated in boiler.

Heating Systems. Practical Means of Preventing Corrosion of Iron and Steel Where Not Exposed Directly to the Atmosphere, F. N. Speller. Thirty-Ninth Gen. Meeting, Am. Electrochemical Soc., April 21-23, 1921, advance paper no. 5, pp. 37-46, 2 figs. Methods of deoxidizing water to prevent corrosion in hot-water heating systems.

Iron and Steel. Experiments on the Corrosion of Iron and Steel, T. S. Fuller. Am. Electrochemical Soc., Thirty-Ninth Gen. Meeting, April 21-23, 1921, no. 29, pp. 337-346, 16 figs. Observations of behavior of drops of water standing on pure iron and other metals, also standing partly on iron and partly on zinc or brass. Oxidation is usually perceptible in one minute and quite marked in 15 min.

Some Observations on the Mechanism of the Increased Corrosion Resistance of Steel and Iron Due to Small Copper Contents, D. M. Buck. Thirty-Ninth Gen. Meeting, Am. Electrochemical Soc., April 21-23, 1921, advance paper no. 6, pp. 47-53, 3 figs. Results of experiments.

The Corrosion of Old Iron, E. A. Richardson and L. T. Richardson. Thirty-Ninth Gen. Meeting, Am. Electrochemical Soc., April 21-23, 1921, advance paper no. 7, pp. 55-58. Analyses of specimens of iron and steel which had been subjected to atmospheric corrosion for 35 yr. Those containing over 0.10 per cent copper were in good condition, while of those containing less than 0.10 per cent copper some were in fair condition and others in poor condition.

Iron and Steel Pipe. Control of Corrosion in Iron and Steel Pipes, F. N. Speller. Jl. Eng. Inst. Canada, vol. 4, no. 4, April 1921, pp. 233-237, 2 figs. Causes of corrosion, external and internal, in iron and steel pipe mains with summary of control methods.

Non-Ferrous. Some Types of Non-Ferrous Corrosion, H. S. Rawdon. Thirty-Ninth Gen. Meeting, Am. Electrochemical Soc., April 21-23, 1921, advance paper no. 9, pp. 73-79, 8 figs. Examples of each of four types of corrosion: Selective attack of certain constituents; intercrystalline brittleness; internal oxidation; and simultaneous action of stress and corrosion.

Prevention. Principles of Alloying to Resist Corrosion, Oliver P. Watts. Thirty-Ninth Gen. Meeting, Am. Electrochemical Soc., April 21-23, 1921, advance paper no. 10, pp. 81-84, 1 fig. General principle is laid down that less corrodible alloys are either metallic compounds of simple chemical formula or solid solutions of more resisting metals in each other. Test proving protective action of copper in steel is given.

Theories. A Practical Aspect of the Corrosion Problem, John F. Thompson. Am. Electrochemical Soc., Thirty-Ninth Gen. Meeting, April 21-23, 1921, no. 30, pp. 347-354. Comparative study of various corrosion theories.

CRANES

Hammerhead. A Hammerhead Crane for the Harbour of Christiana, Norway (En Stor Kran). Teknisk Ukeblad, vol. 68, no. 2, Jan. 14, 1921, pp. 20-22, 2 figs. Cranes lifts 100 tons to a height of 25 m. and is intended mainly for installation and removal of boilers and ship engines. Its largest radius is 28 m.; motors, operated by alternating current at 220 volts, have a total capacity of 238 hp.

CUTTING TOOLS

Standards. Report of the German Industry Committee on Standards (Mitteilungen des Normenausschusses der Deutschen Industrie). Betrieb, (special no.) vol. 3, no. 11, Mar., 1921, pp. 147-152, 7 figs. Proposed new standards for hand wheels, grain milling rolls, and cutting tools.

CYLINDERS

Block Production. Utilization of Special Machines in Cylinder Block Production, J. Edward Schipper. Automotive Industries, vol. 44, no. 14, April 7, 1921, pp. 756-759, 22 figs. Manufacture of Paige Cylinder blocks.

D

DAMS

Hydraulic-Fill. Hydraulic Fill Practice on Terrace Reservoir Dam, John E. Field. Eng. News-Rec., vol. 86, no. 14, April 7, 1921, pp. 597-609, 3 figs. Construction of earth-fill dam in Southern Colorado. Studies of flume lining place cast-iron plates first and green spruce blocks second in durability.

DIE CASTING

Developments. Die-Casting Methods and Metals—I, M. H. Potter. Foundry, vol. 49, no. 8, April 15, 1921, pp. 303-306. Advantages and limitations of die casting are discussed and development and present-day practice are outlined.

DIES

Bending. The Design and Construction of Press Tools. Eng. Production, vol. 2, nos. 24 and 26, Mar. 17 and 31, 1921, pp. 346-348, 8 figs., and 404-405, 6 figs. Design of bending and curling dies.

DIESEL ENGINES

Marine. Adjustment of Crosshead-Pin Bearings and Main Bearings of Marine Diesel Engines, Louis R. Ford. Power, vol. 53, no. 14, April 5, 1921, pp. 546-547, 3 figs. Details of procedure.

Building Diesel Marine Engines for Seagoing Vessels—II, Fred B. Jacobs. Mar. Rev., vol. 51, no. 5, May 1921, pp. 221-229, 23 figs. Practice at works of Busch-Sulzer Bros., St. Louis, Mo.

The Polar Marine Diesel Engines. Practical Engr., vol. 63, no. 1775, Mar. 3, 1921, pp. 134-137, 4 figs. Four-cylinder type developing 500 b.hp. at 150 r.p.m.

Nordberg. Largest Stationary Diesel Engine in the United States. Power, vol. 53, no. 13, Mar. 29, 1921, pp. 498-501, 7 figs. Nordberg 2000 b.hp. vertical Diesel engine of valve-in-head scavenging two-stroke-cycle, single-acting type. Four power cylinders, 500 b.hp. each, scavenging pump and air compressor driven by crankshaft. Engines to be direct-connected to 1350-kw. a. c. generators to supply electrical service to copper mines.

Oil-Fuel Injection. Some Experiments in Connection with the Injection and Combustion of Fuel Oil in Diesel Engines, C. J. Hawkes. Trans. North-East Coast Instn. Engrs. & Shipbuilders, vol. 37, part 2, Dec. 1920, pp. 37-92, 28 figs. Experiments carried out at British Admiralty Engineering Laboratory in connection with development of high-speed engines for naval purposes.

Standardization. Standardized Diesel Engines—II, H. R. Setz. Mar. Eng., vol. 26, no. 4, April 1921, pp. 324-328, 8 figs. Discussion of construction involving four valves in cylinder head. Study of propelling characteristics.

DRILL CHUCKS

Manufacture. Application of Interchangeability to Drill Chuck Manufacture—II. Machy. (Lond.), vol. 17, no. 442, Mar. 17, 1921, pp. 725-730, 18 figs. Tooling and gaging equipment employed in manufacturing Casler twin-screw drill chuck.

DRILLS

Standard. Report of the German Industry Committee on Standards (Mitteilungen des Normenausschusses der Deutschen Industrie). Betrieb, vol. 3, no. 13, Mar. 25, 1921 pp. 171-180, 11 figs. Proposals of the Board of Directors for tool tapers, Morse tapers, conical reamers for Morse and metric tapers, and metric tapers. As a basis for the standardization of the Morse tapers the original table of the Morse Twist Drill & Machine Co., New Bedford, Mass., is used.

DROP FORGINGS

Malleable Iron versus. Why Drop Forgings Are Replacing Malleable Iron Castings, F. B. Fairbanks. Forging & Heat Treating, vol. 7, no. 3, Mar. 1921, pp. 173-175, 8 figs. Comparative study of photomicrographs.

E

EARTH

Pressure of. Effect of Practical Factors on Earth-Pressure Theory. George Paaswell. Eng. News-Rec., vol. 86, no. 16, April 21, 1921, pp. 682-683, 1 fig. Many observed phenomena are due to cohesion but designing for non-coherent material is conservative practice.

ELECTRIC CIRCUITS, A.C.

Inductive Interference. Inductive Interference of Power Circuits with Communication Circuits, A. C. Caldwell and E. Marsden. New Zealand Jl. Sci. & Technology, vol. 3, nos. 5 and 6, Jan. 1921, pp. 286-295, 7 figs. Records of measurements.

ELECTRIC DISTRIBUTION

Economics. The Distribution of Electricity, W. B. Woodhouse. Jl. Instn. Elec. Engrs., vol. 59, no. 297, Jan. 1921, pp. 85-93, 7 figs. Conditions of economic distribution are determined by conflicting technical and financial considerations, necessity for several working pressure is shown, and general expression is obtained for capital expenditure on mains and substations.

Some Economic Aspects of Extra-High-Tension Distribution by Underground Cable, Reginald O. Kapp. Jl. Instn. Elec. Engrs., vol. 59, no. 297, Jan. 1921, pp. 94-107, 18 figs. Rules are given with reference to design of cable layouts and for determing most economical voltage of transmission. It is shown that after allowance for diversity factor and stand-by cables had been made, total kva. capacity of feeders leaving power station is still considerably greater than maximum station load, on account of uneven sharing of load, and means are suggested for reducing discrepancy

ELECTRIC DRIVE

Steel Mills. The Frequency Problem in the Steel Industry, B. C. Lamme. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 4, April 1921, pp. 294-300. Possibilities for utilization of 50 cycles. Comparative advantages and disadvantages of 25 and 60 cycles.

ELECTRIC FURNACES

Inductive. Recent Progress in High Frequency Inductive Heating, E. F. Northrup. Am. Electrochemical Soc., Thirty-Ninth Gen. Meeting, April 21-23, 1921, paper no. 18, pp. 179-200, 13 figs. Furnaces of certain types are described and actual performances given, showing them to run at 30 to 40 per cent electrothermal efficiency.

Muffled Arc. New Types of Electric Furnaces. Metal Industry, (N. Y.), vol. 19, no. 4, April 1921, pp. 149-150, 4 figs. Muffled are furnaces developed by Gen. Elec. Co. for melting non-ferrous metal.

Non-Ferrous Alloys. Electric Furnaces for Non-Ferrous Alloys, H. W. Gillett. Am. Electrochemical Soc., Thirty-Ninth Gen. Meeting, April 21-23, 1921, no. 24, pp. 277-195. Tabulates in detail all electric furnaces in U. S. smelting non-ferrous metals giving kind of furnace, users and capacity per heat. There are 323 electric furnaces in 144 different plants with capacity of 193 tons per single heat and using 42,350 kw.

Open-Hearth Versus. Makes Comparison of Melting Costs. Foundry, vol. 49, no. 8, April 15, 1921, pp. 315-318, 3 figs. Ohio Steel Castings Co. operating both electric and open-hearth furnace gives data covering two processes from which estimated costs are calculated.

Steel Manufacture. Electric Furnaces for Making Steel—II, Alfred Stansfield. Blast Furnace & Steel Plant, vol. 9, no. 4, April 1921, pp. 263-266, 5 figs. Classification of electric steel-making furnaces. General features and advantages of arc furnace and resistance furnace. Operating features of electric furnaces.

The Regulation of Electric Steel Arc Furnaces Using Movable Electrodes, W. G. Mylius. Thirty-Ninth Gen. Meeting, Am. Electrochemical Soc., April 21-23, 1921, advance paper no. 20, pp. 213-225, 8 figs. Discussion of difficulties of operating arc furnaces for smelting steel, particularly when melting cold scrap, and of kinds of arc current regulators which have been devised to maintain some function of power input constant, such as current, voltage, watts, or a combination of these.

ELECTRIC LOCOMOTIVES

Swiss. Swiss Electric Locomotive Progress. Elec. Ry. Jl., vol. 57, no. 16, April 16, 1921, pp. 724-727, 9 figs. Details are given of recent locomotives manufactured by leading two builders of electrical apparatus in Switzerland. Particular attention is given to machines for federal railways. Some experiments with new types of drive are included, indicating leaning toward gears as substitute for side rods.

ELECTRIC MOTORS

Temperature Rise. Temperature Rise with Short-Time Loads, R. E. Hellmund. Elec. World, vol. 77, no. 13, Mar. 26, 1921, pp. 707-709, 1 fig. Equations for temperature rise.

ELECTRIC MOTORS, A.C.

Induction. On the Design of Split Phase Motors, E. A. Binney. Elecn., vol. 86, no. 2235, Mar. 18, 1921, pp. 322-325, 9 figs. Design of single phase induction motor having main or winding and auxiliary or starting winding on stator and squirrel-cage rotor.

ELECTRIC SWITCHES

Bus Short Circuits. New Type of Switch House Prevents Bus Short Circuits, B. G. Jamieson. Elec. World, vol. 77, no. 14, April 2, 1921, pp. 761-763, 5 figs. Wide separation of bus phases in new Calumet plant of Commonwealth Edison Co. precludes interphase short circuits. Current-limiting reactors are utilized for purpose of excluding outside disturbances.

ELECTRIC TRANSMISSION LINES

Calculations. Calculation of Overhead Transmission Lines (Calculs mécanique des lignes aériennes). Revue générale de l'Électricité, vol. 9, no. 11, Mar. 12, 1921, pp. 349-360, 15 figs. Equations for determining tension in conductors. Calculation of size of conductors needed. Committee report presented to Professional Syndicate of Electrical Industries.

Calculations, Diagrams and Control of Long Distance Electric Transmissions Lines (Calculs, diagrammes et régulation des lignes de transport d'énergie à longue distance), P. Thielemans. Revue générale de l'Électricité, vol. 9, no. 14, April 2, 1921, pp. 451-460, 7 figs. In former article published in Revue générale de l'Électricité, Sept. 25 and Oct. 2, 9 and 16, pp. 403-416, 435-443, 475-482 and 515-529, writer explained graphical method for studying behavior of electric transmission lines, and gave examples of application of method in concrete cases. In present article method is generalized and is applied in particular to study of line by sections. (To be continued.)

Stresses in Wires. Cable Spans with Suspension Insulators, I. R. Robinson, New Zealand Jl. Sci. & Technology, vol. 3, nos. 5 and 6, Jan. 1921, pp. 280-285, 1 fig. Derivation of formula for computing tension, for different temperatures, of wire of high-tension transmission line with suspension insulators.

Suspension-Insulator. Stringing Suspension-Insulator Lines in Rough Country, Murray J. Idail. Elec. World, vol. 77, no. 15, April 9, 1921, pp. 812-814, 1 fig. All spans between dead-end towers are pulled to same tension, one such that elastic limit is not exceeded under maximum loading conditions. Basis for investigations.

ELECTRICAL MACHINERY

Standards. Standards for Electrical Machinery Adopted by International Electrotechnical Commission (Norme per le macchine elettriche adottate dalla Commissione Elettrotecnica Internazionale. Rivista tecnica d'elettricita, vol. 54, no. 1977, Jan. 30, 1921, pp. 22-25. Units in which characteristics of motors, generators, transformers, etc. must be specified. (Concluded.)

ELECTRIC WELDING ARC

Rate of Cutting. Solving Arc Welding Problems, A. M. Candy. Iron Trade Rev., vol. 68, no. 12, Mar. 24, 1921, pp. 829-835, 19 figs. Graphs showing rate of cutting cast iron, malleable iron and steel by arc process. Tests of welds. Paper read before Am. Foundrymen's Assn.

Theory of. Phenomena of Arc Welding, O. H. Eschholz. Thirty-Ninth Gen. Meeting, Am. Electrochemical Soc., April 21-23, 1921, advance paper no. 8, pp. 59-71, 16 figs. Study of metal deposition, fusion and arc stability during electric welding.

ELECTROLYSIS

Water Mains. Electrolysis Mitigation in Winnipeg, W. Nelson Smith. Elec. Ry. Jl., vol. 57, no. 13, Mar. 26, 1921, pp. 584-589, 5 figs. Three-wire system has been applied to bring ground return conditions of Winnipeg Elec. Ry. into conformity with electrolysis act passed by legislature of Province of Manitoba. Act was passed after investigation of Manitoba Public Utilities Commission into corrosion of cast-iron water mains in Winnipeg.

ELECTROPLATING

Iron. Metal Plating, W. G. Knox. Metal Industry, vol. 19, no. 4, April 1921, pp. 160-162, 2 figs. Table showing time required to deposit given thickness of iron with different values of current density.

EMPLOYEES

Rating. Giving the Worker a Card-Index Rating, Frank H. Williams. Iron Age, vol. 107, no. 16, April 21, 1921, pp. 1033-1035, 1 fig. Practice of S. F. Bowser & Co., Ft. Wayne, Ind., manufacturers of storage systems for oil and gasoline. Employees are marked monthly on 10 pts. Records form bases for production.

EMPLOYMENT MANAGEMENT

Employees Lists. What About Your Labor Force When Business Picks Up? Factory, vol. 26, no. 7, April 1, 1921, pp. 831-834, 1 fig. Advises record of names, addresses and qualifications of workers applying for positions, even though at time of application they cannot be hired, with a view to insure sufficient supply of workers when production again demands.

Promotion Methods. Keeping Employees in Line for Promotion, Robert I. Clegg. Iron Age, vol. 107, no. 12, Mar. 24, 1921, pp. 761-763, 2 figs. Forms for keeping perpetual inventory of employees giving record of service, successive promotions, personal elements, outside activities, education and hobbies.

ENGINEERS

Civic Duties. Engineering in a Broader Aspect, Dean Mortimer E. Cooley. Michigan Technic, 34, no. 1, Mar. 1921, pp. 18-24. Urges organized co-operation of engineers among themselves and their participation in civic affairs as duties engineers owe to modern complex civilization.

Professional Practice. Operating Costs of Engineering Practice. Eng. News-Rec., vol. 86, no. 13, Mar. 31, 1921, pp. 542-543, 3 figs. Factors include education, capacity, class of work, and direct and indirect expenses of business. Organization chart of an engineering firm. Forms for cost keeping.

Registration. Licensing of Engineers. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 27, no. 3, April 1921, pp. 320-335. Abstract covering present status of legislation for licensing of engineers in various states. Report of Publication Committee, Am. Soc. of Heat. & Vent. Engrs.

Remuneration. Fees for Practicing Engineers. Eng. World, vol. 18, no. 4, April 1921, pp. 247-251, 4 figs. Progress report made by committee of Am. Assn. of Engrs.

ENAMELING

Electric Furnaces. Electric Heat Raises Enameling Output. James W. Carpenter. Elec. World, vol. 77, no. 16, April 16, 1921, pp. 873-875, 1 fig. Operating data from St. Louis installation.

EXCAVATORS

Mechanical. Mechanical Excavators (Les excavateurs mécaniques). Génie Civil, vol. 78, no. 9, Feb. 26, 1921, pp. 185-190, 12 figs. Survey of recent developments and uses.

EXPLOSIONS

Grain Dust. Dust Explosion at Large Chicago Grain Elevator. Eng. News-Rec., vol. 86, no. 13, Mar. 31, 1921, pp. 560-562, 2 figs. Explosion in Chicago grain elevator of Chicago & Northwestern Railway. Six men were killed and 4 injured, and about 500,000 bushels of grain were lost or damaged.

F

FACTORIES

Construction. Auto Body Plant Built of Reinforced Concrete. V. E. Winell. Concrete, vol. 18, no. 4, April 1921, pp. 160-164, 6 figs. Plan and layout of Fisher Body Ohio Co.'s plant.

Layout. Plant Layout Studies by Concrete Institute Committee. Eng. News-Rec., vol. 86, no. 12, Mar. 24, 1921, pp. 505-507, 4 figs. Report submitted at annual convention embodies description of, and comparative costs upon seven fundamental types.

FACTORY MANAGEMENT

See Industrial Management.

FATIGUE

Steel Works. Fatigue and Efficiency in Iron and Steel Works—IV. H. M. Vernon. Eng. & Indus. Management, vol. 5, no. 11, Mar. 17, 1921, pp. 320-323, 2 figs. Investigations undertaken for British Industrial Fatigue Research Board. Influence of reduction of hours on rolling-mill output.

FERRONICKEL

Anomaly of Expansion. Effect of Additions in the Anomaly of Expansion of Ferronickels—Application to Ferro-Nickel-Chrome Alloys (L'action des additions sur l'anomalie de dilatation des ferronickels; application aux alliages fer-nickel-chrome), M. P. Chevenard. Comptes rendus des Séances de l'Académie des Sciences, vol. 172, no. 10, Mar. 7, 1921, pp. 594-596, 2 figs. Graphs plotted from results obtained in experiments.

FIREBRICK

Tests. Comparing Brick for Boiler Furnace Linings, R. C. Brierly. Combustion, vol. 4, no. 4, April 1921, pp. 20-22 and 41, 2 figs. Records of tests.

FLOORS

Flat-Slab. Flat-Slab Floors Built Without Drops or Capitals. Eng. News-Rec., vol. 86, no. 16, April 21, 1921, pp. 672-673, 2 figs. Procedure followed in construction of seven story building in San Francisco.

Gypsum-Block. Use Special Light Gypsum Blocks in Floor Construction, A. V. Bekay. Eng. News-Rec., vol. 86, no. 13, Mar. 31, 1921, pp. 544-546, 5 figs. Floor construction of seven-story reinforced-concrete frame apartment house. Gypsum tile blocks, producible on quantity basis, were used in manner of well-known tile and joist systems.

FLOW OF WATER

Measurements. Measuring Water Flow for Power Purposes, N. R. Gibson. Mech. Eng., vol. 43, no. 4, April 1921, pp. 247-248, 1 fig. Description of Gibson method and apparatus and account of its application in efficiency tests of 37,500-hp. turbines of Niagara Fall Power Co. Mean velocity of column of water in penstock by recording changes of pressure at point in pipe line when flow of water therein is gradually brought to rest by closing valve or turbine gates. Mean change or pressure recorded is measure of velocity destroyed.

Subsoil. Subsoil Water Flow with Special Reference to Water Logging. W. Hickey. Indian Eng., vol. 60, no. 7, Feb. 12, 1921, pp. 94-96, 9 figs. Depression curves statistics from tube well. (To be continued.)

FOUNDATIONS

Concrete. Foundation of Multiple Concrete Ring Girders for New York Court House, Carlton S. Proctor. Eng. News-Rec., vol. 86, no. 12, Mar. 24, 1921, pp. 494-497, 6 figs. Prevention of unequal settlement controlling problem in supporting heavy monumental building of hexagonal ground plan on sand.

FREIGHT HANDLING

Bibliography. Bibliography on Freight Handling, R. F. Emerson. Gen. Elec. Rev., vol. 24, no. 4, April 1921, pp. 371-380. List of articles on general subject of material handling that have appeared in technical press since 1914.

FUELS

Ash, Fusibility of. What Constituents in Ash Cause It to Fuse, G. A. deGraaf. Coal Age, vol. 19, no. 12, Mar. 24, 1921, pp. 534-539, 5 figs. Graphs showing relation of fusing temperature of ash to percentage of silica, iron oxide and sulphur.

Calorific Value. A Proposed New Measure of Calorific Power, E. Damour. Gas Jl., vol. 151, no. 3021, April 6, 1921, pp. 29-30, 1 fig. Measurement o calorific power of fuels, particularly wood, peat and lignite and other substitutes for coal. Duplex-combustion producer furnace for utilization of low-grade fuels. Translated from Chimie et Industrie.

Colloidal. Properties and Characteristics of Colloidal Fuel, Lindon W. Bates and Haylett O'Neill. Power Plant Eng., vol. 25, no. 7, April 1, 1921, pp. 368-369, 2 figs. Graphs showing heating value of colloidal fuel of different compositions. Papers read before Royal Soc. Arts.

Domestic. The Relative Efficiency of Coal, Gas, and Electricity for Domestic Purposes, E. Marsden and (Miss) E. W. J. Fenton. New Zealand Jl. Sci. & Technology, vol. 3, nos. 5 and 6, Jan. 1921, pp. 257-270, 7 figs. It was found in tests that gas is over three times and electricity over four times more expensive for general domestic purposes than coal.

Economical Utilization. Work of the Committee on Utilization of Fuels (Travaux de la commission d'utilisation des combustibles), V. Kammerer. Bulletin de la Société d'Encouragement pour l'Industrie nationale, vol. 120, no. 3, Mar. 1921, pp. 286-301. Committee report submitted to French Ministry of Public Works. Instructions are formulated for engineers and assistants and suggestions are given in regard to economical production and utilization of steam. From Journal officiel, Feb. 20, 1921.

FURNACES ANNEALING

Sheet. Heating Furnaces and Annealing Furnaces, W. Trinks. Blast Furnace & Steel Plant, vol. 9, no. 4, April 1921, pp. 267-272, 20 figs. Comparison of different types of sheet furnaces.

FURNACES BOILER

Construction. Working Pressure on Furnaces, John S. Watts. Boiler Maker, vol. 21, no. 4, April 1921, pp. 112-114, 1 fig. Chart for calculating thickness of boiler furnaces to conform with requirements of principal classification societies.

FURNACES FORGING

Gas-Fired. The Application of Gas to Forging Furnaces. Forging & Heat Treating, vol. 7, No. 3, Mar. 1921, pp. 178-181. Results of tests. Paper read before Am. Gas Assn.

FURNACES HEATING

Ingot. Heating Furnaces and Annealing Furnaces, W. Trinks. Forging & Heat Treating, vol. 7, no. 3, Mar. 1921, pp. 159-161, 8 figs. Critical comparison of different types of furnaces in use for heating of heavy forging ingots.

G

GAGES

Precision. Precision Gauge Manufacture, Arthur G. Robson. Engr., vol. 131, no. 3404, Mar. 25, 1921, pp. 312-314, 26 figs. Jigs and fixtures employed. Example of calculations involved.

Spline. Making Inserted Spline Gauges. Machy. (Lond.), vol. 18, no. 443, Mar. 24, 1921, pp. 768-770, 6 figs. Method of milling splines and flats.

GAS MANUFACTURE

Retorts. Steaming Horizontal Retorts, L. Stock. Gas Jl., vol. 153, no. 3020, Mar. 30, 1921, pp. 804-805, 2 figs. Goffin retort-setting at Frankfurt Gas-Works. (Abstract.) Paper read before Mid-Rhine Gas Assn. Translated from German Gas Jl.

GEAR CUTTING

Fixtures. Efficient Fixtures Used in Gear Cutting, Douglas T. Hamilton. Can. Machy., vol. 25, no. 13, Mar. 31, 1921, pp. 33-36, 10 figs. Methods of testing truth of arbor and work.

GEARS

Bevel. Turning Bevel Gear Blanks. Eng. Production, vol. 2, no. 26, Mar. 31, 1921, pp. 411-414, 13 figs. Production on automatic machines.

Helical. The Production of Helical Gears. Eng. Production vol. 2, no. 27, April 7, 1921, pp. 440-443, 8 figs. Procedure in works of Citroën Gear Co., France.

Involute. Angles of Approach, Recess and Contact of Involute Gears, A. B. Cox. Am. Mach., vol. 54, no. 13, Mar. 31, 1921, pp. 559-561, 6 figs. Derivation of formulas

Involute Gear Problems, H. E. Kitchen. Machy. (London), vol. 18, no. 445, April 7, 1921, pp. 11-14, 6 figs. Enlarging gears without backlash. Avoidance of undercut.

The Evolution of the Involute Gear Tooth A. Fisher. Machy. (Lond.), vol. 17, nos. 441-444, Mar. 10 and 31, 1921, pp. 714-718, 9 figs., and 806-809, 11 figs. Early solutions of odontoid; general rolled curve or roulette solution.

Maag System. The Maag System of Gearing—I. Engr., vol. 131, no. 3403 Mar. 18, 1921, pp. 283-285, 5 figs. Generating cutting machine. Involute teeth are generated by means of reciprocating rack cutter with straight-side teeth.

Production System. Quantity Production in a Gear Shop—I, Fred R. Daniels. Machy. (N. Y.), vol. 27, no. 8, April 1921, pp. 763-766, 10 figs. Practice of Dittmer Gear & Mfg. Corp., Lockport, N. Y., in manufacture of gears for tractors, trucks and automobiles.

GOLD METALLURGY

Antimonial Ore Treatment. Treatment of Antimonial Gold Ore at the Globe and Phoenix Gold Mine, Southern Rhodesia, V. E. Robinson. Jl. Chem. Metallurgical & Min. Soc., vol. 21, no. 7, Jan. 1921, pp. 117-119. Owing to stibnite present and also possibly to ferrous iron tailing cannot be treated directly by cyanide, but if it be allowed to partially oxidize by weathering, it becomes amenable to cyaniding.

GRAIN ELEVATORS

Farm. Cribs and Granaries—Modern Farm Elevators. Concrete, vol. 18, no. 4, April 1921, pp. 175-180, 18 figs. Types of building in common use. Notes on their design.

The Design of Farm Elevators, W. G. Kaiser and W. A. Foster. Agricultural Engr., vol. 2, no. 3, Mar. 1921, pp. 51-56, 13 figs. Types of structures in common use. Notes on their design. Committee report presented at meeting of Am. Soc. of Agricultural Engrs.

Pneumatic. Pneumatic Elevators in Theory and Practice, William Cramp. Jl. Royal Soc. of Arts, vol. 69, no. 3566, Mar. 25, 1921, pp. 283-297, 14 figs. Typical installations. Study of pressure exerted by air on grain. Equations of motion of grain.

GRAIN HANDLING

Pneumatic. Pneumatic Elevators in Theory and Practice, William Cramp. Jl. Royal Soc. of Arts, vol. 49, no. 3566, Mar. 25, 1921, pp. 283-294 and (discussion) pp. 294-297, 14 figs. Experimental measurement of grain velocity. Equation expressing relation between velocity of grain and pressure of air. Conditions which limit efficiency of vertical conveyor.

GRINDING

Cylindrical. Points to Consider in Cylindrical Grinding, W. H. Chapman. Can. Machy., vol. 25, no. 13, Mar. 31, 1921, pp. 41-44, 2 figs. Factors which determine wheel-wearing action. Laws relating to draw-in and traversed cuts. Production costs.

Fixtures. The Use of Special Fixtures in Grinding Operations, Ellsworth Sheldon. Am. Mach., vol. 54, no. 13, Mar. 31, 1921, pp. 545-548, 14 figs. Use of gear as chuck upon which to finish another gear. Grinding tapers without traverse.

GYPSUM

Properties. Gypsum—Properties, Definitions and Uses. U. S. Dept. of Commerce, Circular of Bur. of Standards, no. 108, Jan. 3, 1921, 21 pp. Specifications are included for calcium gypsum, neat gypsum plaster, gypsum plaster board and gypsum wall board.

Properties. The Relation Between the Fineness and Other Properties of Calcined Gypsum, W. E. Emley and F. C. Welch. Jl. Am. Ceramic Soc., vol. 4, no. 4, April 1921, pp. 301-305. Measurements of normal consistency, time of set and plasticity.

H

HANDLING MATERIALS

Electrically Operated Machinery. The Field for Electrically Operated Material Handling Machinery, F. T. Smith. Gen. Elec. Rev., vol. 24, no. 4, April 1921, pp. 361-365. 6 figs. Typical installations.

Freight-Handling Devices. A Brief Directory of Material Handling Apparatus, R. H. McLain. Gen. Elec. Rev., vol. 24, no. 4 April 1921, pp. 306-317, 46 figs. Descriptions and illustrations of freight-handling devices which are suitable for handling different classes of material through horizontal and vertical motion over long and short distances.

Routing. The Application of Power-Driven Machinery to the Horizontal Transference of Miscellaneous Freight, J. A. Jackson. Gen. Elec. Rev., vol 24, no. 4, April 1921, pp. 325-330, 6 figs. Fundamental principles of routing that must be observed to secure efficient system for transferring miscellaneous freight or material within building.

HARDNESS

Testing. The Study of Bar Hardness Tests (Étude sur l'essai de dureté à la bille), René Guillery. Mémoires et Compte rendu des Travaux de la Société des Ingénieurs Civils de France, vol. 73, nos. 10, 11 and 12, Oct.-Dec. 1920, pp. 591-606, 22 figs. partly on supp. plate. Research on the elimination of time elements in Brinell tests. Apparatus measuring by impact given by hammer.

HEATING AND VENTILATION

Fire Hazards. Fire Hazards Connected with Heating and Ventilating Work, Ira H. Woolson. Jl. Am. Soc. Heat .& Vent. Engrs., vol. 27, no. 3, April 1921, pp. 286-292. Suggestions based upon statistics of insurance losses paid by companies reporting to Acturial Bur. of Nat. Board of Fire Underwriters for five years 1915-1919 inclusive.

HEATING, ELECTRIC

Heating and Cooking Apparatus. The Status of Electric Heating and Cooking Apparatus (Der Stand der elektrischen Heiz- und Kochapparate), H. Wintermeyer. Elektrotechnischer Anzeiger, vol. 38, no. 44, Mar. 19, 1921, pp. 253-258, 4 figs. Review of foreign and domestic patented improvements.

Switzerland. The Employment of Electricity for Heating (Die Verwendung der Elektrizität in der Heizungstechnik), R. Gautschi. Gesundheits-Ingenieur, vol. 44, no. 2, Jan. 8, 1921, pp. 13-17, 6 figs. Describes construction and operation of electric central and separate heating installations in Switzerland. Comparison of the cost of heating with use of black and white coal. Notes on hot-water heating operated with night current; heat storage tanks; electrically heated high-pressure boilers, etc.

HEAT TRANSMISSION

Building Materials. The Heat Conduction Coefficients of Building and Insulating Materials and the Coefficient of Permeability of New Building Types (Die Warmeleitzahl von Bau-und Isoloerstoffen und die Wärmedurchlässigkeitzahl neuer Bauweisen), Osc. Knoblauch, E. Raisch and H. Reiher. Gesundheits-Ingenieur, vol. 43, no. 52, Dec. 25, 1920, pp. 607-623, 4 figs. Part I gives results of experiments carried out in years 1912-1920 for determination of heat conductivity of building and insulating materials. Part II gives results of tests carried out consecutively since 1918 on experimental houses for determination of permeability of certain wall constructions. The most important conclusions are summarized. See also same journal, vol. 44, no. 9, Feb. 26, 1921, pp. 100-101. (Remarks by H. Chr. Nussbaum).

Radiation. Present Status of the Constants and Verification of the Laws of Thermal Radiation of a Uniformly Heated inclosure, W. W. Coblentz. U. S. Dept. of Commerce, Sci. Papers, Bur. of Standards, no. 406, Dec. 20, 1920, 48 pp. Examination into various determinations and methods employed in determining radiation constants by different experimenters. Comparison of accuracy of results obtained therewith.

HOISTS

Skip. Provisions that Enable the Skip Hoist at Coal Mines to Give Maximum Service, Andrews Allen and John A. Garcia. Coal Age, vol. 19, no. 12, Mar. 24, 1921, pp. 529-533, 4 figs. Where skip hoisting is employed bottom layout differs radically from that used with cage hoisting. Although four kinds of dumps are available rotary is variety most generally installed. Paper read before Am. Inst. Min. & Metallurgical Engrs.

HOUSES, CONCRETE

Construction. Recommended Practice for Concrete House Construction. Eng. & Contracting, vol. 55, no. 12, Mar. 23. 1921, pp. 278-279. Report of committee on concrete houses, Am. Concrete Inst.

Fireproofing. Fireproofing a Concrete Block House, Wharton Clay. Eng. World, vol. 18, no. 4, April 1921, pp. 275-276. Recommendation of Nat. Conference of concrete house construction.

Ingersoll-Rand System. How the Ingersoll-Rand Company is Solving Its Housing Problem with Concrete. Concrete Age, vol. 33, no. 6, Mar. 1921, pp. 18-23, 6 figs. Wooden forms are set up for complete houses by one operation.

Machine-Made. Machine-Made Reinforced Concrete Houses and Other Structures, F. G. Engholm. Can. Engr., vol. 40, no. 13, Mar. 31, 1921, pp. 337-342, 6 figs. Details of machine-made parts for concrete structures.

HYDRAULIC TURBINES

Design. The Modern Hydraulic Turbine, Frank H. Rogers. Jl. Engrs. Club of Phila., vol. 38-3, no. 195, Mar. 1921, pp. 77-90, 25 figs. Modern requirements. Tests on models as adjunct to design. General and special features of design.

Development. The Present Trend of Turbine Development, Lewis F. Moody. Mech. Eng., vol. 43, no. 4, April 1921, pp. 235-244, 17 figs. Also Jl. Engrs. Club of Phila., vol. 38-3, no. 195, Mar. 1921, pp. 106-123, 25 figs. Brief survey of past history and recent progress, together with discussion of theoretical problems involved in hydraulics of modern high-speed trubine, notably determinations of turbine and pump efficiencies as related to specific speed.

EFFICIENCY Economic Importance of the Efficiency of Hydraulic Turbines for New Construction and Reconstruction (Wirtschaftliche Bedeutung des Wirkungsgrades der Wasserturbinen für Entscheidungen beim Neubau und Umbau), H Leiner Zeit. des Vereines deutscher Ingenieure, vol 65, no 9, Feb 26, 1921, pp 222-224 Development of equations to be considered in the determination of economic efficiency of turbines It is shown that old installations have for the most part lost their significance from an economic standpoint. In the case of new construction, selection of construction type should be made with due regard to economic influence of its efficiency

Maximum Efficiency of Turbines (Sur le rendement maximum des turbines), M de Sparre. Comptes rendus des Séances de l'Académie des Sciences, vol 172, no. 10, Mar 7, 1921, pp. 561-564 Formulas

Thermometric Method for Measuring Efficiency of Hydraulic Turbines (Sur une méthode thermométrique de mesure du rendement des turbines hydrauliques), L. Barbillion and A. Poirson. Houille Blanche, vol 19, nos. 47 and 48, Nov.-Dec. 1920, pp 217-221. 2 figs Principle of method consists in assuming that quantity of heat corresponding to energy loss is employed in heating water

EFFICIENCY TESTS. The Application of a New Method of Water Measurement in the Efficiency Tests of the 37,500 H.P. Turbines of the Niagara Falls Power Company, N. R Gibson: Jl. Engrs Club of Phila., vol. 38-3, no. 195, Mar. 1921, pp. 90-101, 18 figs. Description of Gibson method and apparatus for measuring flow of water in penstocks. Comparison of volumetric and Gibson measurements.

SPEED REGULATION. Speed Regulation of the Hydraulic Turbine. Raymond D. Johnson. Mech. Eng., vol. 43, no. 4, April 1921, pp 245-246 and 248, 2 figs. Also Jl. Engrs. Club of Phila., vol. 38-3, no. 195, Mar 1921, pp. 101-106, 7 figs. Notes on design of surge thanks. Graph showing typical variations of water level in both thank and standpipe of differential regulator.

HYDRO-ELECTRIC PLANTS

CANADA. Canada's Superpower Zone, Robert G. Skerrett. Sci. Am., vol. 124, no. 13, Mar. 26, 1921, pp. 246 and 258, 1 fig Scheme worked out by Ontario hydro-electric power commission.

Hydro-Electric Progress in Canada During Past Year, J. B. Challies. Contract. Rec., vol. 35, no. 12, Mar. 23. 1921, pp. 298-301. In 1920, 650,000 hp. was completed or under construction. Active government development of power resources. Canada next to Norway in amount developed.

FRANCE. Utilization of the Hydraulic Energy in the Vienne River in West of France (Usines électriques de la Société des Forces motrices dd la Vienne), Auguste Pawlowski. Génie Civil, vol. 78, no. 14, April 2, 1921, pp. 285-289, 10 figs. Construction of three plants, one of 6000 hp., one of 8000 hp. and one of 9000 hp.

ELECTRICAL FEATURES. Electrical Features of Hydro-Electric Power, David Barker Rushmore. Jl. Engrs. Club of Phila., vol. 38-3, no. 195, Mar. 1921, pp. 123-129. Enumeration of electrical apparatus involved.

QUEENSTON-CHIPPAWA PROJETS, ONTARIO. 50,000-Hp. Wheels for 500,000-Hp. Plant, E. T. J. Brandon. Elec. World, vol. 77, no. 13, Mar. 26, 1921, pp. 697-699, 6 figs. Five 45,000-kva. generators already on order for Queenston-Chippawa project in Ontario. Unit system followed for electrical layout. Generators set below floor level. Control pedestals at generators.

SWEDEN. The Glomfjord Hydro-electric Plant, Sweden (Glomfjord Kraftanlæg), Ragnvald Lie. Teknisk Ukeblad, vol. 68, nos. 5 and 6, Feb. 4 and 11, 1921, pp. 50-53 and 61-65, 10 figs. The available volume of water is 25 cu.m. per sec. and is supplied from a number of lakes located in high altitudes; the entire water supply is 585 million cu.m., the head, 450 m. At present six turbines for 160,000 hp. are to be installed, of which 25,000 hp. are to be held as reserve. Notes on preliminary construction work.

SWITZERLAND. New Hydro-electric Plant under Construction in the Canton of Grisons. Switzerland (Die Landquartwerke der "Bündner Kraftwerke"), R. Moor. Schweizerische Bauzeitung, vol. 77, no. 12, Mar. 19, 1921, pp. 127-130, 7 figs. Details of Kloster-Kublis power plant designed by and being constructed under supervision of writers. Plant is first stadium of large project for harnessing Land-quart river and its tributaries.

I

ICE PLANTS

ELECTRIC VS. STEAM DRIVE. Electrification of the Ice Industry, Donald Cole. Ice & Refrigeration, vol. 60, no. 3, Mar. 1921, pp. 175-176. Comparison of manufacturing costs in electrically-driven and steam-driven ice plants.

INDICATORS

STEAM-ENGINE. Determination of the Continuous Output of Reciprocating Steam Engines (Die Feststellung der Dauer-Betriebsleistung von Kolbendampfmaschinen). Kali, vol. 15, no. 4, Feb. 15, 1921, pp. 53-58, 6 figs. Power meter and load indicator with recording device constructed by Anton Böttcher, Hamburg, and power meter by Gümbel, Charlottenburg.

INDUSTRIAL MANAGEMENT

ATTITUDE OF ORGANIZED LABOR. Union Labor and the Enlightened Employer, Samuel Gompers. Indus. Management, vol. 61, no. 7, April 1, 1921, pp. 235-239. Attitude of organized labor toward management open shop crusade, collective bargaining, and present day economic problems.

ACCIDENT PREVENTION. Safety and Accident Prevention, Fred. G. Lange. Indus. Management, vol. 61 no. 7, April 1, 1921, pp. 257-259. Explains accident prevention as phase of industrial management.

CENTRAL CONTROL Central Control System in the Franklin Plant Franklin D Jones Machy. (N Y), vol 27, no 8, April 1921, pp 745-749 6 figs Also in Machy. (Lond), vol 18, no 445, Apr 7, 1921, pp 1-6, 6 figs System employed by H H Franklin Mfg Co, for regulating output according to demand and for controlling manufacturing operations by mechanical boards or charts and pneumatically operated dispatch system.

DEVELOPMENTS The Evolution of Industrial Management, Henry R Towne Indus Management, vol 61, no 7, April 1, 1921, pp. 231-233 Review of developments during last 30 years

Thirty Years of Management Literature, John R Dunlap Indus Management, vol 61, no. 7, April 1, 1921, pp 279-283 and 311. Survey of developments in industrial management published in last 30 years. (To be continued.)

INCENTIVES TO WORKERS. Incentives to Better Workmanship Appeal to a Variety of Instincts. Norman G Shidle. Automotive Industries, vol. 44, no. 13, Mar. 31, 1921, pp 712-714 Plan of classification of employees and opportunities offered for their advancement at plant of Sperry Gyroscope Co.

INSTRUCTION SHEETS. Proposals for New Factory Instruction Sheets (Entwürfe neuer Betriebsblätter) Betrieb, vol. 3, no. 12, Mar 10, 1921, pp. 84-85 Proposals of Committee for Economic Production for instruction sheet for the handling and erection of machine tools.

PRODUCTION SYSTEMS Making Pay Envelopes Reflect Merit, R. A. Ilg Factory, vol. 26, no. 7, April 1, 1921, pp. 837-839, 3 figs. Production records are posted where employees can see them. Bulletin board causes workman's natural pride to show itself in increased production. Bonuses are paid for increased production.

Production in a General Engineering Shop. Eng. Production, vol. 2, no. 25, Mar. 24 1921, pp 385-390, 16 figs. Works and methods of Messrs. Peter Brotherhood, Ltd., London.

The Trend Toward Automatic Production, A. L. DeLeeuw. Indus. Management, vol. 61, no. 7, April 1, 1921, pp. 251-255. Developments in production systems during last 30 years.

Works Organisation Eng. Production, vol. 2, no. 25, Mar. 24, 1921, pp. 391-395, 15 figs. Production systems of British automobile manufacturer.

ROUTING MATERIALS. Co-Ordinating the Industrial Plant Through Intra-Factory Transportation, W. F. Merrill. Indus. Management, vol. 61, no. 7, April 1, 1921, pp 261-265, 5 figs. Economics of intra-factory transportation.

TOOLROOM ORGANIZATION. Distribution of Tools (Die Werkzeugausgabe), Th. Damm. Betrieb, vol. 3, no. 10, Feb. 25, 1921, pp. 282-284, 3 figs. Fundamental aspects are discussed, and practical equipment, arrangements and organization methods are suggested which have proved successful in practice.

INDUSTRIAL RELATIONS

AMERICAN INDUSTRIES. What America Faces, Herbert Hoover. Indus. Management, vol. 61, no. 7, April 1, 1921, pp. 225-229. Review and forecast of fundamental relationships between employer and employee. It is pointed out that although there are no conflicts of interest between employee and employer, there are also "wide areas of activity in which their interests should coincide, and it is the part of statesmanship on both sides to organize this indentity of interest in order to limit the area of conflict."

GANTT'S METHOD OF INQUIRY. Principles of Industrial Philosophy, Walter N. Polakov. Mech. Eng., vol. 43. no. 4, April 1921, pp. 249-252 and (discussion) pp. 253-254, 5 figs. Gantt's method of inquiry into co-relation of social needs and industrial services. Application and influence of principles enunciated by Gantt.

ELECTRICAL CONSTRUCTION INDUSTRY. National Labor Council for the Electrical Construction Industry. Monthly Labor Rev., vol. 12, no. 3. Mar. 1921, pp. 126-127. Plan adopted in April 1920, by Nat. Assn. of Elec. Contractors and Dealers and Nat. Brotherhood of Elec. Workers. Purposes of Council are said to be "promotion of peace and harmony in electrical industry, the adjudication of disputes between employers and employees, the establishment of friendly relations between all parties interested, which should ultimately result in the elimination of distrust, suspicion, and the wasteful methods of the old-fashioned strikes and lockouts."

PENNSYLVANIA RAILROAD. Joint Reviewing Committee of the Pennsylva niaRailroad System. Monthly Labor Rev., vol. 12, no. 3, Mar. 1921, pp. 122-125. Duty of Reviewing Committee is "amicable settlement, by joint conference, of all controversial questions affecting engine and train service men." Plan was adopted at meeting held on Dec. 29, 1920 by representatives of employees and representatives of administrative force of railroad.

PLANS. Industrial Relations Work Pays, James W. Brown. Iron Trade Rev., vol. 68, no. 13, Mar. 31, 1921, pp. 906-908. Outlines plan to promote family spirit in industrial life of all employees. Paper read before Am. Foundrymen's Assn.

SHOP COUNCILS. One Year of the Shop Council System in Germany. Am. Mach., vol. 54, no. 16, April 21, 1921, pp. 682. Occasional strikes, steady rise in wages, unwarrantable interference and failure in increasing production are conditions reported by managers of industrial works.

INDUSTRIAL TRUCKS

ELECTRIC. Electric Vehicles for Railway Cartage Work. Ry. Gaz., vol. 34, no. 11, Mar. 18, 1921, pp. 426-427 and 429, 5 figs. Trucks used by Great Northern Ry., England. Data on running costs.

Electric Trucks and Industrial Locomotives. Engr., vol. 131, nos. 3403 and 3404, Mar. 18 and 25, 1921, pp. 290-292 and 294, 10 figs., and 318-319, 6 figs. Typical British designs.

INSULATORS, ELECTRIC

Testing. Features of European Insulator Testing Practice, B. Schapira. Eng. World, vol. 18, no. 4, April 1921, pp. 259-262, 8 figs. Testing practice as carried on in Schomburg Works at Margarethenhutte, Germany.

INTERNAL-COMBUSTION ENGINES

Compensation Gear. Tappet Clearance Compensating Gear. Engineering, vol. 111, no. 2882, Mar. 25, 1921, pp. 352-353, 5 figs. Gear providing for automatic cancellation of effects of expansion differences.

Design. The Internal Combustion Engine—Fuel, Valves and Ignition, A. W Bradbury. Trans. Inst. Mar. Engrs., vol. 32, Feb. 1921, pp. 381-404, 14 figs. Design features of typical engines.

Thermodynamic Cycles in Relation to the Design and Future Development of Internal-Combustion Engines, William J. Walker. Jl. Instn. Mech. Engrs., no. 10, Feb. 1921, pp. 1235-1261 and (discussion) pp. 1261-1311, 24 figs. Classification of engine types. Variable specific heat relationship between maximum pressure and mean effective pressure in variable volume cycle. Study based on results obtained in tests of internal-combustion engine, including those operated by coal-gas and producer-gas, oil engines of Diesel and semi-Diesel types, hot-bulb engines and also high speed gasoline engines of automotive class.

Exhaust-Gas Utilization. The Carbonization of Wood by the Exhaust Gases from Internal Combustion Engines (La carbonisation du bois par l'échappement des moteurs à explosion), Louis Tissier. Chimie & Industrie, vol. 5, no. 2, Feb. 1921, pp. 136-142, 1 fig. Tissier furnace. Exhaust gases pass through pile of wood. High temperature of gases carbonizes wood.

Uses. Internal Combustion Engines, C. S. Darling. Beama, vol. 8, no. 3, Mar. 1921, pp. 248-263, 5 figs. General considerations determining use with reference to power generation.

See also Aeroplane Engines; Automobile Engines; Diesel Engines; Gas Engines; Gas Turbine; Lubrication, Internal-Combustion Engines; Oil Engines; Semi-Diesel Engines; Tractor Engines.

IRON

Corrosion-Resisting. The Effect of Copper and Silver Salts on the Corrosion of Iron by Acids, Oliver P. Watts and Harold C. Knapp. Thirty-Ninth Gen. Meeting, Am. Electrochemical Soc., April 21-23, 1921, advance paper no. 14, pp. 135-140, 1 fig. Record of tests on corrosion of iron by sulphuric acid in absence or presence of various salts of copper and silver. Conclusion drawn is that in general corrosion is stimulated by presence of these salts.

IRON ORES

Mesaba Range. The Utilization of Lean Iron Ores, A. J. Hain. Iron & Steel of Canada, vol. 4, no. 2, Mar. 1921, pp. 35-38. Progress in utilization of lean magnetites of eastern Mesaba range by grinding, magnetic concentration and sintering.

L

LABOR

Hours of Work. One Year of the Eight-Hour Law in Sweden. Monthly Labor Review, vol. 12, no. 3, Mar. 1921, pp. 97-98. "Confronted with the unsatisfactory results" of 8-hour law Swedish Government has commissioned Royal Social Board to investigate and report upon advisability of modification of its provisions.

LATHE TOOLS

Turret Lathes. Tooling the Modern Turret Lathe, A. H. Lloyd. Can. Machy. vol. 25, no. 12, Mar. 24, 1921, pp. 33-36, 9 figs. Tools for machining magneto cam case; gun-metal bush and motorcycle flywheel.

LATHES

Bench. Tools and Methods for Manufacturing Precision Bench Lathes—II. Machy. (N.Y.), vol. 27, no. 8, April 1921, pp. 751-754, 9 figs. Practice of S. A. Potter Tool & Machine Works, New York City, in manufacture of bench lathes.

Standards. Report of the German Industry Committee on Standards (Mitteilungen des Normenausschusses der Deutschen Industrie). Betrieb, vol. 3, no. 12, Mar. 10, 1921, pp. 159-161, 4 figs. Proposal of the Board of Directors for speed cones. Proposed standards for hand wheels.

LAUNCHING

Tallows for. Some Experiments on Tallows Used for Launching Ships, J.J. King-Slater. Engineering, vol. 111, no. 2883, April 1, 1921, pp. 405-407, 2 figs. Curves of compression strength and hardness factors against temperatures for various natural tallows. Paper read before Instn. Naval Architects.

LIGNITE

Utilization. New Recommendations for the Rational Utilization of Bituminous Wet Lignites (Neuve Vorschläge zur rationellen Ausnutzung bituminöser nasser Braunkohle), Gh. Limberg. Braunkhole, vol. 19, no. 46, Feb. 26, 1921, pp. 570-574, 1 fig. Notes on distillation at low temperature for the production of low-temperature coke. (Concluded).

LOCOMOTIVE BOILERS

Heavy Freight Locomotives. Details of New Santa Fe Locomotive Boilers. Boiler Maker, vol 21, no. 4, April 1921, pp. 95-100 and 124, 7 figs. Conical design built for working pressure of 195 lb. per sq. in. Outside diameter of course is 88 in., while diameter of rear course is 100 in. Firebox is 132 in. long and 96 in. wide.

LOCOMOTIVES

Bearings. Shop Methods of Casting Locomotive Bearings, J. V. Hunter. Am. Mach., vol. 54 no. 14, April 7, 1921, pp. 590-596, 23 figs. Comparison of methods used in shops of Wabash Railroad Big Four System and Chicago & Alton Railway.

British. 4-6-4 Type Tank Locomotive for the Furness Railway. Engineering vol. 111, no. 2882 Mar. 25, 1921 pp. 356-357, 6 figs. partly on supp. plate. Characteristics: Cylinders, 19½ in. by 26 in.; wheels, coupled diameter, 5 ft. 8 in.; wheelbase, coupled, 13 ft. 3 in.; heating surface tubes, 1850 sq. ft.; heating surface fire-box, 153 sq. ft.

New Express Locomotives for the Bengal-Nagpur Railway. Ry. Gaz., vol. 34, no. 11, Mar. 18, 1921, pp. 428-429, 3 figs. Characteristics: Type, 4-6-0; cylinders, 21½ in. diameter by 26-in. stroke; diameter of driving wheels, 6 ft. 1½ in.; total evaporative surface, 1259 sq. ft.; superheating surface, 250 sq. ft.; tractive force, 23,554 lb.

Powerful Side Tank "Ghat" Locomotives for the Great Indian Peninsula Railway. Ry. Gaz., vol. 34, no. 12, Mar. 25, 1921, pp. 475, 1 fig. Characteristics: Cylinders, diameter, 22 in.; piston stroke, 26 in.; wheelbase, coupled wheels, 15 ft. 6 in.; weight on coupled wheels, 78 tons 16 cwt.

Coaling Stations. Coaling Station for City Engine Terminal: O. & R. R. Eng. News-Rec., vol. 86 no. 16, April 21, 1921, pp. 673-674, 3 figs. Three grades of coal. Operator handles chutes. One hoist service for coal and sand. Large sand drying plant.

Mine, Internal-Combustion. German Internal-Combustion Locomotives. Gas & Oil Power, 16, no. 187, April 7, 1921, pp. 109-110, 3 figs. Mine locomotive built by Deutz Gas Engine Co.

Reconstruction. Locomotives and Locomotive Terminals. Mech. Eng., vol. 43, no. 4, April 1921, pp. 255-258 and 272. Salient points brought out in discussion of papers on increasing capacity of old locomotives and modernizing locomotive terminals, presented at railroad session of Am. Soc. Mech. Engrs. 1920 annual meeting.

Stoker-Fired. Operating Economies in Longer Runs, F. M. Nellis. Ry. Rev., vol. 68, no. 14, April 2, 1921, pp. 535-536. Experience of Erie Railroad.

Throttle Valve for. Design of an Improved Locomotive Throttle Valve, W. J. Knox. Ry. Mech. Engr., vol. 95, no. 4, April 1921, pp. 216-218, 10 figs. Type developed by Buffalo, Rochester & Pittsburgh Railroad.

LUBRICATING OILS

Reclamation. The Reclamation of Lubricating Oils (La régéneration des huiles de graissage). Bulletin technique du Bureau Veritas, vol. 3, no. 3, Mar. 1921, pp. 64-67, 3 figs. Salaün apparatus for reclamation of lubricating oils.

Tests. Tests on Lubricating Oil for Two-Stroke-Cycle Semi-Diesel Engines, T. M. Robie. Power, vol. 53, no. 15, April 12, 1921, pp. 588-590, 2 figs. Graphs showing influence of temperature on viscosity of lubricating oils.

M

MACHINE TOOLS

Hydraulic. Hydraulic Machine Tools. Managing Engr., vol. 7, no. 11, Mar. 1921, pp. 201-203, 5 figs. Forging press, cold plate shears, plate flanger, marine boiler riveter, etc. Paper read before Gloucestershire Eng. Soc.

Steels for Parts. Steels for Machine Tool Parts, Robert M. Taylor. Machy. (Y.Y.), vol. 27, no. 8, April 1921, pp. 770-771. Table of required properties of steel for machine tool parts. (Abstract). Paper read before Am. Soc. for Steel Treating.

MACHINERY

Production Statistics. Statistics of Production in Machine Construction (Produktionsstatistik im Maschinenbau), H. Rech. Betrieb, vol. 3, no. 9, Feb. 10, 1921, pp. 221-230, 3 figs., 2 on supp. plate. Deals with organization for collecting statistics of production instituted by Assn. of German-Machine Builders in 1907. Compilation of results is given in tables showing extent of employment, importance of export, development of prices, operating efficiency, etc., since 1909.

MALLEABLE CASTINGS

Automotive Industry. Malleable Castings Production as Related to the Automotive Industry. Automotive Industries, vol. 44, no. 13, Mar. 31, 1921, pp. 708-711, 1 fig. Technical and commercial development of malleable castings production.

Steel vs. Malleable Castings vs. Grey Iron and Steel, Enrique Touceda. Can. Foundryman, vol. 12, no. 4, April 1921, pp. 26-28, 4 figs. Ability to stand abuse static and dynamic strength, ease of machining, smoothness of surface. Properties and limitations of malleable-iron castings.

MALLEABLE IRON

Annealing. Anneals Malleable Iron with Oil Fuel, William F. Hoernke. Foundry, vol. 49, no. 8, April 15, 1921, pp. 323-325, 3 figs. Experience of Stowell Co., Milwaukee. Oil is more expensive fuel but requires less labor in handling and firing.

Properties. American Malleable Cast Iron, H. A. Schwartz. Iron Trade Rev., vol. 68, nos. 13 and 15, Mar. 31 and April 14, 1921, pp. 901-904, 8 figs. and 1003-1012, 5 figs. Series of articles dealing with development of industry, modern methods of manufacture, metallurgical principles involved and properties of American malleable iron. Thermal and electrical properties of malleable iron.

MARINE BOILERS

Standard Construction. Standard Conditions for the Design and Construction of Marine Boilers. Steamship, vol. 32, no. 382, April 1921, pp. 239-242. Regulations issued by British Board of Trade. (To be continued.)

MARINE STEAM TURBINES

Reversing. A Description of a New Reversing Turbine. Mar. Eng., vol. 11, no. 1, Jan. 1921, pp. 40-42, 2 figs. Device to regulate steam supply automatically.

METALS

Calorizing. Protecting Metals Against Heat by Calorizing, Arthur V. Farr. Raw Material, vol. 4, no. 3, Mar. 1921, pp. 86-89, 6 figs. Process of calorizing consists in placing material in retort and heating in reducing atmosphere, retort being filled with mixture containing finely divided aluminum. Homogeneous aluminum alloy is formed for certain depth.

Fatigue of. Tests Support Theory of Fatigue, H. F. Moore. Iron Trade Rev., vol. 68, no. 13, Mar. 31, 1921, pp. 895-897, 3 figs. Experiments conducted on metals which were subjected to alternate and repeated strains that failure from fatigue is due largely to growth of minute flaws.

Properties. Physical Properties of Materials. U. S. Dept. of Commerce, Circular of Bur. of Standards, no. 101, Feb. 9, 1921, 52 pp. Strengths and related properties of metals and other engineering materials. Revision of Smithsonian physical tables.

MILLING

Gang Milling. Gang Milling. Eng. Production, vol. 2, no. 24, Mar. 17, 1921, pp. 342-345, 14 figs. Notes on cutters employed and their arrangement.

MILLING CUTTERS

Teeth, Spacing of. Metal Cutting Tools—VIII, A. L. DeLeeuw. Am. Mach., vol. 54, no. 15, April 14, 1921, pp. 635-640, 16 figs. Spacing of teeth of milling cutters.

MILLING MACHINES

Automatic. A New Automatic Miller. Eng. Production, vol. 2, no. 24, Mar. 17, 1921, pp. 340-341, 5 figs. Machines intended for manufacture of duplicating parts in large quantities. Spindle and table are controlled automatically. Manufactured by Buck and Hickman, London.

Continuous. Continuous Milling, J. H. Moore. Can. Machy., vol. 25, no. 14, April 7, 1921, pp. 65-68, 9 figs. Rotary and reciprocating types of continuous milling machines.

High-Power. Rockford Milling Machine. Iron Age, vol. 107, no. 16, April 21, 1921, pp. 1039-1040, 2 figs. High-power, all-geared, single-pulley milling machine recently brought out by Rockford Milling Machine Co., Rockford, Ill. Rectangular overarm moved by rack and pinion. Single control for feed and quick return.

Rockford No. 3 "High-Power" Milling Machine, J. V. Hunter. Am. Mach., vol. 54, no. 14, April 7, 1921, pp. 585-587, 5 figs.

MINES

Ventilation. Ventilation in Metal Mines, Daniel Harrington. U.S. Dept. of Interior, Bur. of Mines, technical paper 251, 1921, 44 pp. Data obtained in experiments made in metal mines in northwestern U. S.

MINING

Costs. Notes and Records of Mining Costs, Arthur B. Pettit. Bul. Instn. Min. & Metallurgy, no. 198, Mar. 1921, 17 pp., 5 figs. Based on data of operation of Witwaters and gold fields.

MOLYBDENUM

Norway. The Molybdenum Mines of Norway (Norske molybdengruber), Otto Falkenberg. Teknisk Ukeblad, vol. 68, no. 1, Jan. 7, 1921, pp. 6-11, 15 figs. Occurrences and properties of molybdenum. Norway has only specular molybdenum ore. Notes on production and treatment mainly in Elmore apparatus. It is used in chemical industry, but mainly with alloyed steels. Prospects.

MOTION-PICTURE PHOTOGRAPHY

200,000 Photographs per Minute. Two Hundred Thousand Photographs per Minute, C. H. Claudy. Sci. Am., vol. 124, no. 15, April 9, 1921, pp. 288-297 and 299, 6 figs. High-speed motion-picture projectors and camera which makes use of prisms instead of usual shutter and intermittent movement mechanism.

MOTOR-PLOWS

Tests. Factors Influencing the Draft of Plows, E. V. Collins. Agricultural Eng., vol. 2, no. 2, Feb. 1921, pp. 27-29, 7 figs. Records of tests.

MOTOR TRUCK TRAFFIC

Legislation. How Maryland Enforces Its Motor Vehicle Law. Eng. News-Rec., vol. 86, no. 16, April 21, 1921, pp. 666-668, 3 figs. Truck weights, checked by scales and loadometers. Ten tons limit. Excess loads deposited at roadsides.

MOTOR TRUCKS

Maintenance. The Care and Maintenance of Motor Trucks, N. J. Smith. Jl. Soc. Automotive Engrs., vol. 8, no. 4, April 1921, pp. 331-334. Practice of Consumers Co., which operates 159 motor trucks for delivering coal, ice and other supplies in territory covering city of Chicago and outlying districts.

Trailers. How to Apply Trucks and Trailers Under Given Load and Road Conditions, Marius C. Krarup. Automotive Industries, vol. 44, no. 12, Mar. 24, 1921, pp. 651-658, 5 figs. Table giving drawbar pull obtainable at speeds from 1 to 20 m.p.h. from net horsepower available at rims of driving wheels. Graph of resistances to vehicle movements due to grades and irregular or soft road surfaces.

MOTORSHIPS

Two-Cycle vs. Four-Cycle Engines. Two Versus Four Cycle Diesel Engines. Mar. Eng., vol. 26, no. 4, April 1921, pp. 321-323, 2 figs. Competition between manufacturers of two types in Europe.

LIGNITE

Utilization. Germany's Brown Coal, Robert G. Skerrett. Sci. Am., vol. 124, no. 16, April 16, 1921, pp. 304 and 315, 2 figs. Industrial utilization of swamp muck.

N

NICKEL

Electrolytic. Ductile Electrolytic Nickel, Chas. P. Madsen. Thirty-Ninth Gen. Meeting Am. Electro-chemical Soc., April 21-23, 1921, advance paper no. 23, pp. 269-276. Experiments confirming writer's discovery that if cathodes in nickel electrollytic bath are periodically lifted out of bath, exposed to air, and reimmersed within certain limiting time, nickel deposit does not laminate but is greatly improved as regards freedom from pitting and mechanical properties.

The Use of Fluorides in Solutions for Nickel Deposition, William Blum. Thirty-Ninth Gen. Meeting, Am. Electrochemical Soc., April 21-23, 1921, advance paper no. 21, pp. 227-247, 3 figs. Discusses factors governing deposition of hard deposits of nickel from solutions containing fluorides, with and without boric acid and other salts. General principles of getting good deposits are discussed, showing that low acidity favors good nickel deposition, but high acidity good anode corrosion. Bearing of hydrogen iron concentration on matter is explained.

NICKEL ALLOYS

Compositions, Properties, Uses. Miscellaneous Alloys of Nickel, Paul D. Merica. Chem. & Metallurgical Eng., vol. 24, no. 15, April 13, 1921, pp. 649-653. Principal data on binary alloy systems with nickel as one constituent. Use of nickel in bronzes and light aluminum alloys. Composition and electrical characteristics of many special resistance alloys. Analyses of complex alloys for various minor uses.

O

OFFICE BUILDINGS

Reinforced-Concrete. Construction Details of General Motors Office Building, Joseph Matte, Jr. Eng. News-Rec., vol. 86, no. 15, April 14, 1921, pp. 624-630, 12 figs. Fifteen-story structure with thirty-two acres of floor space to house 6000 persons. Heavy girders and columns in steel frame. Reinforced-concrete laboratory building.

OIL ENGINES

Densil. A Serviceable Crude-Oil Engine, Steamship, vol. 32, no. 382, April 1921, pp. 251-253. Densil single-cylinder engine of hot-bulb type, with additional water-cooled head distinct from cylinder and bulb.

Marine. Reversing of Marine Oil Engines, Walter Pollock. Trans. Inst. Mar. Engrs., vol. 32, Feb. 1921, pp. 347-380, 10 figs. Classification and description of reversing systems in use.

OIL FIELDS

Argentina. The Petroliferous Region of Cacheuta (La region petrolifera de Cachueta), Guillermo Hileman. Ingenieria Internacional, vol. 5, no. 5, May 1921, pp. 286-289, 3 figs. Geological description of and account of prospecting operation in Argentina region.

Australia. The Possibility of Oil Discovery on the Mainland of Australia, Wm. Clarkson. Petroleum Times, vol. 5, no. 114, Mar. 12, 1921, pp. 309-311. Conditions essential to occurrence of oil in quantity. Prospecting experiences of Australia.

Borneo. The Crude Oils of Borneo, James Kelway. Petroleum Times, vol. 5, no. 115, Mar. 19, 1921, pp. 337-339. Geological and chemical notes.

Canada. Oil Possibilities of the Mackenzie—A Warning. Eng. & Min. Jl., vol. 111, no. 13, Mar. 26, 1921, pp. 553-554. It is said oil dissipation has taken place and transportation is a serious problem.

OIL FIELDS

Northwestern Canada. The Search for Oil in the West, John Ness. Monthly Bul. Can. Inst. Min. & Metallurgy, no. 108, April 1921, pp. 279-311, 20 figs. Notes on geology of regions and account of propecting operations.

OIL INDUSTRY

Canada. Canada a Vast Storehouse of Oil Resources, Earle W. Gage. Gas Engine, vol. 23, no. 4, April 1921, pp. 85-87. Canada's annual oil production, according to government statistics, amounts to nearly 310,000 bbl. 90 per cent from Ontario fields.

United States. America's Petroleum Problem, J. O. Lewis. Jl. Franklin Inst., vol. 191, no. 3, Mar. 1921, pp. 357-379. Probable duration of oil supply in U. S. taking into account continuously increasing rate of consumption of oil. No exhaustion for many generations is apprehended.

OIL FUEL

Burners. Oil Fuel Burners Insuring Complete Preliminary Combustion of Liquid (Brûleur à combustion complète préalable, pour combustibles liquides), Génie Civil, vol. 78, no. 13, Mar. 26, 1921, p. 279, 1 fig. Air and pulverized fuel are thoroughly mixed and ignited in special chamber before passing into furnace proper.

Fuel-Gas Analyses with. Records of Flue Gas Analyses with Fuel Oil, L. J. Goodrich. Power Plant Eng., vol. 25, no. 7, April 1, 1921, pp. 366-367, 2 figs. Calculation of fuel losses from flue-gas analyses and moisture contents of fuel and air.

Stowing on Board Ship. Hydraulic System for Stowing and Handling Fuel Oil on Board Ships in Yards or Docks. Mar. Eng., vol. 26, no. 4, April 1921, pp. 304-305 1 fig. Adaptation of hydraulic system for control of oil fuel of large dredge.

Uses. Fuel Oil, W. A. White. Trans. North-East Coast Instn. Engrs. & Shipbuilders, vol. 37, part 4, Feb. 1921, pp. 209-238, 4 figs. Estimated petroleum deposits of the world. Statistics of production and transport of oil fuel. Typical oil-fuel storage station. Uses of oil fuel.

Oil Fuel. Uses of Oil Fuel (Emploi des combustibles liquides) M. Pillard. Arts et Métiers, vol. 74, no. 4, Jan. 1921, pp. 3-9, 4 figs. Tests on use of oil fuel in industrial furnaces.

OIL SHALES

Colorado. Studies in Colorado Shale Oils, Arthur J. Franks. Chem. & Metallurgical Eng., vol. 24, no. 13, Mar. 30, 1921, pp. 561-564, 2 figs Lighter hydrocarbon oil fractions found to be more saturated than heavier fractions. Methods used in obtaining data. Graphical analysis of distillation cuts, showing temperatures, saturation and specific gravities.

Scotland. The Necessity for Research in the Oil-Shale Industry, Martin J. Cavin, Sci. & Industry, vol. 2, no. 12, Dec. 1920, pp. 746-760, 4 figs. Account of shale-oil industry as developed in Scotland. Steam-regulated pyrolytic distillation. Quality and quantity of oil yields.

OPEN-HEARTH FURNACES

Controlling Valve. New Controlling Valve for Open Hearts, W. H. Wharton. Blast Furnace & Steel Plant, vol. 9, no. 4, April 1921, pp. 253 and 280, 1 fig. Reversing valve combined with air-pressure and volume controlling mechanism.

OXY-ACETYLENE WELDING

Pressure Vessels. Oxy-Acetylene Welding and Cutting, P. E. Willis. Jl. Engrs. Club of St. Louis, vol. 6, no. 1, Jan.-Feb.-Mar. 1921, pp. 13-28. Uses of oxy-acetylene welding torch. Its application to welding of pressure vessels.

P

PAPER INDUSTRY

Canada. The Pulp and Paper Industry of Canada, Ferd. van Bruyssel. Jl. Eng. Inst. Canada, vol. 4, no. 4, April 1921, pp. 250-254. Forest depletion, suggested changes in lumbering regulations, with discussion on advantages of long lease.

PAPER MANUFACTURE

Size Standardization. Standardization of Sizes in the Manufacture of Paper. Paper, vol. 27, no. 27, Mar. 16, 1921, pp. 9-10 & 36. List of proposed standards.

PAVEMENTS, BRICK

Bituminous Filling. Bituminous Filled Brick Pavement With Lugless Brick, C. R. Livingston. Public Works, vol. 50, no. 15, April 9, 1921, pp. 298-300. Difficulties encountered and devices tried for overcoming them in effort to secure uniform joint spacing between lugless brick and to maintain it during rolling. Work done in Scott County, Iowa.

PEAT

Minnesota. Experimental Work on Minnesota Peat Soils, F. J. Alway. Jl. Am. Peat Soc., vol. 14, no. 2, April 1921, pp. 40-47, 2 figs.

Utilization. The Manufacture and Utilization of Peat Fuel, Benj. F. Haanel. Jl. Am. Peat Soc., vol. 14, no. 2, April 1921. pp. 1-25, 3 figs. Curve showing effect on calorific power of wet peat by removing different percentages of total moisture content. Investigation on rate at which drying takes place during operating period. Paper read before Am. Inst. Chem. Engrs.

PIERS

Concrete. Oil Protects Concrete Piers from Sea Water Action, Contract Rec., vol. 35, no. 11, Mar. 16, 1921, pp. 268-272, 8 figs. Examination of test specimens immersed since 1909 shows them covered with tar-like coating which prevents corrosion. Rich wet mixes seem least affected by salt water.

PIG IRON

Manufacture. Foundry Pig Iron in Birmingham District, Y. A. Dyer. Iron Age, vol. 107, no. 14, April 7, 1921, pp. 907-909, 3 figs. Trend towards use of machine-cast pig by foundries. Claimed advantages over sand-cast iron include lower melting point.

PILES

Effect in Clay. Lateral and Vertical Pressure Effect of Piles in Clay, Henry R. Lordly. Contract Rec., vol. 35, no. 11, Mar. 16, 1921, pp. 257-263, 14 figs. Tests showing effect of various methods of grouping on resistance of piles. X-ray pictures determine displacement of clay by driven pile.

PILES, CONCRETE

Sea Water, Action of. The Action of Sea Water on Concrete Piles. Contract Rec., vol. 35, no. 12, Mar. 23, 1921, pp. 288-291, 6 figs. Analysis of tests carried out by Aberthaw Construction Co. during past twelve years.

PIPE CONCRETE

Tests. Test Concrete Pressure Pipe With Encased Steel Diaphragm. Eng. News-Rec., vol. 86, no. 15, April 14, 1921, pp. 645-646, 3 figs. Inside of reinforced-concrete shell is 3/16-in. steel pipe which is welded at joints between cast sections

Irrigation. The Use of Concrete Pipe in Irrigation, F. W. Stanley and Samuel Fortier. U. S. Dept. of Agriculture, bul. 906, Mar. 23, 1921, 54 pp., 36 figs. Information concerning pipe and pipe systems, with suggestions regarding making and laying.

PIPE, IRON

Strength. Collapsing Strength of Iron Pipes and Tubes, W. F. Schaphorst. Power plant Eng., vol. 25, no. 8, April 15, 1921, pp. 431. Chart for determining collapsing of iron pipes.

PIPE, WROUGHT IRON

Manufacture. Manufacture of Wrought Pipe for High Pressures. Machy. (N. Y.), vol. 27, no. 8, April 1921, pp. 755-756, 5 figs. Practice of National Tube Co., Pittsburgh.

PITOT TUBES

Portable Type. Pitot Tube Designed for Use in High Pressure Pipe Lines, Heinrich Homberger. Power, vol. 53, no. 13, Mar. 29, 1921, pp. 494-497, 4 figs. Compact portable type of rigid construction.

PLANING

Production Systems. Production Planing in Machine Tool Plants. Machy. (Lond.), vol. 17, nos. 442 and 444, Mar. 17 and 31, 1921, pp. 747-752, 8 figs., and 793-797, 7 figs. Methods used in shops of representative planer and engine-lathe builders.

Production Planing in Machine Tool Plants—V. Machy. (Lond.), vol. 17, no. 444, Mar. 31, 1921, pp. 793-797, 7 figs. Methods used in planer-building shops.

PLATES

Stresses in. Contact Pressures and Stresses, E. G. Coker, K. C. Chakko and M. S. Ahmed. Engineering, vol. 111, no. 2882, Mar. 25, 1921, pp. 373-376, 10 figs. Analytical study of stress distribution in plate around point at which concentrated load is applied. Experimental confirmation of analytical results. (To be continued.) Paper read before Instn. Mech. Engrs.

PRESSES

Industrial. Penkala Presses for Compression of Materials and Extraction of Liquids Therefrom (Presses système Penkala, pour l'agglomération des matières et pour l'extraction des liquides qui y sont contenus), M. Biver. Génie Civil, vol. 78, no. 13, Mar. 26, 1921; pp. 265-267, 4 figs. Types of industrial presses, particularly presses used for extraction of juice from cane sugar.

PROPELLERS, SHIP

Tests. The Screw Propeller—II. Supplément au bulletin technique du Bureau Veritas, Mar. 1921, pp. 9-16, 4 figs. Results of experiments on model propellers with elliptical blades and with wide, deep blades.

PROTECTIVE COATINGS

Metal Paints. Metal Protective Paints, Henry A Gardner. Thirty-Ninth Gen Meeting, Am. Electro-chemical Soc., April 21-23, 1921, advance paper no. 11, pp 85-87 Chemical classification of substances used as paints on metallic structures

PULVERIZED COAL

Gasification. Gasification of Powdered Coal, A E Bourcoud Chem. & Metallurgical Eng., vol. 24, no. 14, April 6, 1921, pp 600-604, 4 figs. Consideration of velocity with which reaction takes place between producer gas and suspended carbon, using results for estimating proposal for gasifying powdered coal or oil.

Systems of Burning. Powdered Fuel Robert James. Proc. So. Wales Inst. Engrs., vol. 37, no. 1, Mar. 10 1921, pp 73-110, 18 figs. Systems of burning pulverized coal. Use of pulverized coal in boiler furnaces-locomotives, marine boilers, etc.

Uses. Metallurgical Use of Pulverized Fuel, C. F. Herington. Iron Age, vol. 107, no. 15, April 14, 1921, pp. 965-969, 4 figs. Advances made in utilization of powdered coal as fuel in metallurgical furnaces. List of plants and equipment. There are approximately 2000 metallurgical furnaces using pulverized coal. Plants listed are principally in U.S. and Canada.

PUMPS

Air-Lift. Air-Lift Pumps—Information Required for Design, R. M Anderson. Stevens Indicator, vol. 37, no. 4, Oct. 1920, pp. 249-269, 10 figs. Formulas, graphs and tables.

PYROMETERS

Platinum-Resistance. Recent Modifications in the Construction of Platinum Resistance Thermometers, T. S Sligh, Jr., Dept. of Commerce, Sci. Papers, Bur of Standards, no. 407, Jan 5, 1921, pp. 49-63, 2 figs Survey of developments in construction of resistance thermometers as regards heads, leads, terminals and sealing of strain-free type. Elimination of drying head and use of all-metal case with calorimetric type of resistance thermometer.

R

RAILS

Creeping. Rail Creep. Ry. Gaz., vol. 34, no. 11, Mar. 18, 1921, pp. 430-432, 4 figs. Analysis of causes and effects of rail creeping and description of anti-creep anchors.

RAILWAY ELECTRIFICATION

Economic Advantages. Electrification Reviewed from the Standpoint of Service. C. C. Whittaker. Ry. Rev., vol. 68, no. 13, Mar. 26, 1921, pp. 483-487, 4 figs. Operating advantages resulting from substitution of electricity for steam in railway service. Paper presented before Providence Eng. Soc.

The Economic Aspects of Railway Electrification, A. H. Armstrong. Jl. Franklin Inst., vol. 191, no. 4, April 1921, pp. 493-502. Economic advantages of railway electrification, principally from aspect of future growth of transportation system of country and its effect upon national transportation.

France. French Railways Electrification. Elec. Ry. & Tramway Jl., vols. 43 and 44, nos. 1055, 1060, 1064 and 1068, Dec. 10, 1920, Jan. 14, Feb. 11, Mar. 11, 1921, pp. 280-282, 17-19, 61- and 105-107. Official report issued by Ministère des Travaux Publics, containing full details of proceedings of Comité d'Études for electrification of systems of great railways as well as various decisions which have been arrived at in respect of lines to be electrified, sources of hydro-electric power, systems of generation and distribution, voltage and frequency, methods of current collection, types of electric locomotives, costs of establishment and operation, and other cognate matters.

India. The Electrification of Indian Railways—III. Ry. Engr., vol. 42, no. 494, Mar. 1921, pp. 92-97, 15 figs. Advantage of using electric locomotives as compared with steam locomotives on heavily graded sections of North Western Ry. of India.

RAILWAY REPAIR SHOPS

Machining Locomotive Parts. Railway Machine Shop Practice—I, Edward K. Hammond. Machy. (N. Y.), vol. 27, no. 8, April 1921, pp. 721-729, 17 figs. Methods employed in railway repair shops for machining locomotive parts.

RAILWAY SHOPS

Sheet-Metal Work. Sheet-Metal Shop Equipment for Railroad Work, J. V. Hunter. Am. Mach., vol. 54, no. 16, April 21, 1921, pp. 683-686, 11 figs. Typical modern power shears, presses and brakes.

RAILWAY SIGNALING

Electro-Mechanical. Electro-Mechanical Cab Signalling and Train Stop: Great Eastern Railway. Ry. Gaz., vol. 34, no. 10, Mar. 11, 1921, pp. 394-398 and 400, 7 figs.

Interlocking. A New Idea in Traffic Locking on the C. & O., H. E. Johnson. Ry. Signal Engr., vol. 14, no. 4, April 1921, pp. 129-131, 7 figs. Traffic-locking scheme developed in order to increase track capacity on congested portions of road.

Non-Interlocking. Non-Interlocking Non-Stop Grade Crossings, L. B. Porter. Ry. Signal Engr., vol. 14, no. 4, April 1921, pp. 144-147, 3 figs. Proposed signal layout to control train movements automatically at intersection points to prevent train stops.

RAILWAY TRACK

Ballast. Specifications for Stone Ballast Are Adopted Cement, Mill & Quarry, vol 18, no 7, April 5, 1921, pp 31-32 Committee report submitted to Am. Ry. Eng Assn

Easement Curves. Present Practice Favors Use of Easement Curves Ry Age, vol 70, no 15, April 15, 1921, pp 933-936 Answers to questionnaire regarding use of easement curves sent out to chief engineers of 42 railways in U. S. and Canada.

RAINFALL

Probable Intensities. The Prediction of Probable Rainfall Intensities, Kenneth Allen. Eng News-Rec., vol 86, no 14, April 7, 1921, pp. 588-590, 3 figs. Study based on records at Central Park, New York City, for 51 years, 1869 to 1920. Proposed curves for 5, 10, 15, 25 and 50 years and proposed maximum curve.

RAILWAYS

Light. On the Question of Safety Appliances on Light Railways Subject XX for Discussion at the Ninth Congress of the International Railway Association, Serge de Kareischa. Bul. Int. Ry. Assn., vol. 3, no 3, Mar 1921, pp. 247-304 Report based on answers received from 63 railways in different countries, operating 75 lines

REDUCTION GEARS

Double. Mechanical Gears, of Double Reduction, for Merchant Ships, R. J. Walker and S. S. Cook. Engineering, vol. 111, no. 2882, Mar. 25, 1921, pp. 369-370, 3 figs. Graphs showing torque variation at gear wheel end of propeller shaft determined in experiments on S. S. San Fernando. Paper read before Instn. Naval Architects.

REFRIGERATING MACHINES

Ethyl Chloride. The Ethyl Chloride Refrigerating Machine, Charles Bishop. Cold Storage & Ice Assn., vol. 17, no. 1, 1920-1921, pp 51-63 and (discussion) pp. 64-71, 4 figs. on 4 supp. plates. Installation of Clothel system in Canadian ships.

RELAYS

Protective Devices. Relay Protective Features of the Toronto Power Company's Transmission and Distribution System, P. Ackerman. Jl. Eng. Inst. Canada, vol. 4, no. 4, April 1921, pp. 238-249, 14 figs. Time limit protection, parallel feeder protection, double line protection and ground selector have been successively installed. Comparative study of operating results of various protective schemes.

RESEARCH

Industrial. The Co-operation of Scientific and Industrial Research in the Iron Foundry, Thos. Vickers. Foundry Trade Jl., vol. 23, no. 241, Mar. 31, 1921, pp. 288-290. Economic advantage of co-operation. (To be continued.) Paper read before Instn. British Foundrymen.

Industrial, Belgium. Organization of Scientific and Industrial Research in Belgium (Organisation de la recherche scientifique et industrielle en Belgique), Edgar Forgeur. Revue Universelle des Mines, vol. 8, no. 6, Mar. 15, 1921, pp. 501-522, 1 fig. Suggested scheme for national organization under Central Board of Control.

Scientific. Promotion of Scientific Research, William Hoskins and Russell Wiles. Chem. & Metallurgical Eng., vol. 24, no. 16, April 20, 1921, pp. 689-691. Outline of program for forwarding research in chemical and physical sciences at Universities. Industries licensed under patentable discoveries to pay reasonable royalties for support of further research,

ROAD CONSTRUCTION

Asphalt Base. Asphalt as a Base Material in Road Construction. Contract Rec., vol. 35, no. 13, Mar. 30, 1921, pp. 316-319. Recommendations of Asphalt Assn. for penetration and mixed types of asphalt base.

Bituminous Surface. "Cover" for Bituminous Surface Treatments. John Stanley Crandell. Can. Engr., vol. 40, no. 15, April 14, 1921, pp. 377-378, 3 figs. Methods of handling cover.

Cost. What is the Justifiable First Cost of Highway? J. E. Pennybacker. Contract Rec., vol. 35, no. 14, April 6, 1921, pp. 333-335, 3 figs. Explains method of proportioning outlay to traffic value of project. Determination of anticipated traffic is fundamental idea in scheme.

ROADS .

Impact Tests. Indications from Motor Truck Impact Tests. Eng. News-Rec., vol. 86, no. 13, Mar. 31, 1921, pp. 553-556, 7 figs. Report of U. S. Bur. of Public Roads on research work with wide variety of motor trucks, loads, speeds and tires. (Abstract.)

Subgrades. Investigations of Road Subgrades. A. T. Goldbeck. Jl. Soc. Automotive Engrs., vol. 8, no. 4, April 1921, pp. 339-346, 7 figs. Tests being conducted by Bur. of Public Roads.

ROADS, CONCRETE

California. California Highway System Investigated by Federal Bureau. Eng. News-Rec., vol. 86, no. 11, Mar. 17, 1921, pp. 469-471, 3 figs. Investigations of California State Highway system by U. S. Bur of Public Roads. Report classifies condition of 1262 miles of 4-in. concrete pavement. Failures on Adobe sub-base studied.

Slab. Illinois Has New Concrete Road Slab Design. Eng. News-Rec., vol. 86. no. 12, Mar. 24, 1921, p. 504, 1 fig. Corrugated iron strip down center of slab and smooth rod reinforcement at sides to localize cracking.

Specifications. Delaware Highway Designs and Specifications. Public Works, vol. 50, no. 13, Mar. 26, 1921, pp. 261-263, 3 figs. Important features of specifications with reference to freight rate compensation, excavation, mixing, finishing and protecting concrete, bridge construction, etc.

ROLLING MILLS

Mannesmann Process. Mannesmann Process Rolling Machinery, Carl Gruber. Iron Age, vol. 107, no. 16, April 21, 1921, pp. 1049-1052, 13 figs. Design of rolling mill and its machinery. Details of adjustment devices and guides and of mandrel. (To be continued.) (Abstract.) Translated from Stahl und Eisen.

RUBBER

Technology. Recent Progress in Rubber Chemistry and Technology—II, Philip Schidrowitz. Chem. Age, (Lond.), vol. 4, no. 91, Mar. 12, 1921, pp. 298-300. Mechanics of vulcanization. Synthetic rubber.

Recent Progress in Rubber Chemistry and Technology—III, Philip Schidrowitz. Chem. Age (Lond.), vol. 4, no. 92, Mar. 19, 1921, pp. 326-328. Accelerators; properties of accelerated mixings.

Recent Progress in Rubber Chemistry and Technology—IV, Philip Schidrowitz. Chem. Age (Lond.), vol. 4, no. 93, Mar. 26, 1921, pp. 354-355, 2 figs. Cord and fabric tires.

Recent Progress in Rubber Chemistry and Technology—I, Philip Schidrowitz. Chem. Age (Lond.), vol. 4, no. 90, Mar. 5, 1921, pp. 272-274. Planting, tapping and working-up of rubber.

Recent Progress in Rubber Chemistry and Technology—V, Philip Schidrowitz. Chem. Age (Lond.), vol. 4, no. 94, April 2, 1921, pp. 390-392. Effect of various ingredients on abrasion and resilience of rubber.

RUDDERS

Design. The Design of Balanced Rudders of the Spade Type, M. E. Denny. Engineering, vol. 111, no. 2882, Mar. 25, 1921, pp. 370-373, 5 figs. Formulas for determining diameter of stock required to deal with bending and twisting moments and power of steering engine adequate to operate rudder, and determination of longitudinal position of stock relative to rudder area. Paper read before Instn. Naval Architects.

S

SCIENTIFIC MANAGEMENT

See Industrial Management.

SCREW MACHINES

Automatic. Magazine Feeds for Automatic Screw Machines. Machy. (Lond.), vol. 18, no. 443, Mar. 24, 1921, pp. 757-762, 10 figs. Special equipments developed by Cleveland Automatic Machine Co., for handling second-operation work.

Producing 900 Float Valve Seats Every Hour, J. H. Moore. Can. Machy., vol. 25, no. 15, April 14, 1921, pp. 25-28, 8 figs. Automatic procedure in making spark plug shells, carbuertor float valve seats, piston wrist pins, transmission bolts, sewing machine screws, cylinder priming bodies and nuts in quantity.

SCREW THREADS

National Screw Thread Commission. Progress Report of the National Screw Thread Commission. Dept. of Commerce, Bur. of Standards, no. 42. Jan. 4, 1921, 109 pp., 44 figs. National Screw Thread Commission was created by Act of Congress approved July 18, 1918, for the purpose of ascertaining and establishing standards for screw threads for use of the various branches of the Federal Government and for the use of manufacturers. Report recommends certain systems of threads, and gives information, date and specifications pertaining to manufacture of threads recommended.

SEMI-DIESEL ENGINES

Beardmore. The Beardmore Semi-Diesel Oil Engine. Mar. Eng., vol. 11, no. 3, Mar. 1921, pp. 17-20 16 figs. Four-cylinder unit manufactured by William Beardmore & Co., Glasgow. Ignition is effected by hot bulb.

Tuxham. The Semi-Diesel Engine (Le moteur semi-diesel). Revue de l'Ingénieur, vol. 28, no. 2, Feb. 1921, pp. 69-77, 4 figs. Description of Tuxham motor built at Delaunay-Belleville works.

SHAFTS

Standardization. Standard Shaft versus Standard Hole (Einheistwelle oder Einheitsbohrung?). Betrieb, vol. 3, no. 13, Mar. 25, 1921, pp. 181-184. Report of sub-committee before the working committee for allowances of the German Industry Committee on Standards (NDI).

Stresses in. Graphical Method of Computing Stresses in Shafts of Electric Machines Rotating Between Three Bearings (Complément aux méthodes graphiques de calcul des flèches arbres des machines électriques à trois paliers), P. Durand. Revue générale de l'Electricité, vol. 9, no. 11, Mar. 12, 1921, pp. 369-370, 7 figs. Formulas for computing stresses in vertical shafts.

Tests. Torsion and Torsion Tests of Shafts, Arthur G. Robson. Practical Engr., vol. 63, no. 1779, Mar. 31, 1921, pp. 196-198, 2 figs. Interpretation of results of tests.

SHIP DESIGN

Speed, Depth of Water and. The Influence of the Depth of Water on the Speed of Ships. Engr., vol. 131, nos. 3404 and 3405, Mar. 25, and April 1, 1921, pp. 309-311, 2 figs., and 340-342, 4 figs. Records of experiments conducted by British Admiralty. Survey of literature. Calculations.

SHIP PROPULSION, ELECTRIC

U. S. S. Tennessee. Propelling Machinery of the U. S. S. Tennessee. Mar. Eng., vol. 26, no. 4, April 1921, pp. 269-273, 7 figs. Latest American battleship driven by electricity generated in Westinghouse turbine generators delivering 40,000 hp.

SHIP SALVAGING

Italian Battleship. The Salving of the Italian Battleship Leonardo da Vinci. Engr., vol. 131, no. 3403, Mar. 18, 1921, pp. 281-283, 16 figs., partly on supp. plate. As result of explosion battleship sank in six fathoms of water. Holes in sides were patched and large number of compartments in ship were rendered airtight under water. Battleship has overall length of 650 ft. and displacement of 22,280 tons.

SHIPBUILDING

Economics. The Relation Between Shipbuilding Production, Prices, and the Freight Market, Maxwell Ballard. Trans. North-East Coast Instn. Engrs. & Shipbuilders, vol. 37, part 3, Jan. 1921, pp. 152-172 and (discussion), pp. 172-184, 11 figs. Statistics of shipbuilding, shipping and freight conditions during and after the war.

Manufacturing Methods. Methods in a Shipbuilding Plant, Fred H. Colvin. Am. Mach., vol. 54, no. 116, April 21, 1921, pp. 672-676, 14 figs. Special machines used by Union Iron Works Plant of Bethlehem Shipbuilding Co., together with work-holding fixtures and labor-saving appliances.

Production Organization. Organization for Ship Production, Wilfrid Ayre. North-East Coast Instn. Engrs. & Shipbuilders, advance paper, Mar. 11, 1921, 22 pp. 9 figs. Basis for shipyard organization as applied to actual construction of main hull structure.

Systems of Construction. A Study of the Framing of a Ship, T. B. Abell. Engineering, vol. 111, no. 2882, Mar. 25, 1921, pp. 376-378, 7 figs. Suggested system of construction. Pillars at middle line or two rows of closel spaced pillars. Paper read before Instn. Naval Architects.

SHIPS

Testing Tank for. The Work of a Ship Testing Tank, G. S. Baker. Ingenieur, vol. 36, no. 6, Feb. 5, 1921, pp. 106-117, 12 figs. Account of research work undertaken at William Froude Nat. Experimental Tank, Holland.

SHOP COMMITTEES

Whitley Councils. The Functions of a Work's Council. Eng. & Indus. Management, vol. 5, no. 14, April 7, 1921, pp. 405-408. Scheme in operation at factory of Cadbury Bros., Birmingham, England.

SLIDE RULES

Vector Type. The Vector Slide-Rule, A. F. Zahn. Jl. Franklin Inst., vol. 191, no. 4, April 1921, pp. 525-528, 2 figs. Slide rule for finding magnitude and line resultant when its combination and its moment about a point are given.

SNOW REMOVAL

New York City. Mechanical Snow Removal. Public Works, vol. 50, no. 12, Mar. 19, 1921, pp. 233-234, 3 figs. Snow removal in New York City streets by caterpillar tractors, plows and trucks.

SOOT BLOWERS

Tests. Development of Mechanical Soot Blowers, Robert June. Blast Furnace & Steel Plant, vol. 9, no. 4, April 1921, pp. 275-279, 6 figs. Tests of mechanical soot blowers with coal, pulverized fuel and oil.

SPRINGS

Helical. Design of Helical Springs, Joseph Kaye Wood. Am. Mach., vol. 54, no. 15, April 14, 1921, pp. 628-632, 4 figs. Alignment chart for determining spring size.

STAYBOLTS

Standardization of. Standardization of Boiler and Staybolt Taps. Ry. Jl., vol. 27, no. 4, April 1921, pp. 12-17, 7 figs. Suggestions and recommendations made by Committee of Am. Ry. Tool Foreman's Assn.

STEAM ENGINES

Governors. The Regulation of Slow-Speed Steam Engines by Means of Slipping Eccentrics (Regeling van een stoomwerktuig met verstelbaar excentriek bij een laag aantal omwentelingen), G. Brouwer. Ingenieur, vol. 36. no. 7, Feb. 12, 1921, pp. 126-131, 8 figs. It it shown that centrifugal governors are not adapatable to slow-speed engines, and an oil-pressure governor without centrifugal action is described which is said to be adaptable for such engines.

See also Marine Steam Turbines.

STEEL

Alloy. *See Alloy Steels.*

Chromium. *See Chromium Steel*

Copper, Influence of. Influence of Copper on Some Physical Properties of Iron and Steel, E. A. Richardson and L. T. Richardson. Chem. & Metallurgical Eng., vol 24, no. 13, Mar. 30, 1921, pp. 565-567 Number of ferrous alloys were made and physical properties of forging, filing, grinding, chiseling and bending determined. It was found that copper caused iron to be red-short and that manganese or chromium removed this difficulty.

Corrosion-Resisting. Observations on the Corrosion of Iron and Steel, J. A. Aupperle and D M Strickland. Thirty-Ninth Gen. Meeting, Am. Electrochemical Soc., April 21-23, 1921, advance paper no. 17, pp. 167-177, 2 figs. Records of tests on pure iron made in open-hearth furnaces, copper iron, plain steel and copper steel, to determine their resistance to sulphuric acid corrosion. Specimen sheets were tested 60 days in each case, either alone or fastened to sheets of pure iron by copper rivets or iron rivets, forming galvanic couples.

Magnet. *See Magnets, Steel for.*

Metallography. The Metallography of Low Carbon Steel, James Mitchell. Jl. West of Scotland Iron & Steel inst., vol 28, part 4, Jan. 1921, pp. 38-45 and (discussion) pp. 45-49, 27 figs. on 4 supp. plates. Interpretation of photomicrographs.

Structural. *See Structural Steel.*

Testing. The Testing of Steel, D. Sillars. Foundry Trade Jl., vol. 23, no. 240, Mar. 24, 1921, pp. 268-270. Comparative value of tests ordinary applied.

STEEL CASTINGS

Centrifugal Process. Tests of Centrifugally Cast Steel, George K. Burgess. Iron Age, vol. 107, no. 12, Mar. 24, 1921, pp. 764-766, 5 figs. Results suggested possible that centrifugally cast steel suitably treated may rival properties of forgings of same chemical composition.

Steel, Heat Treatment of Cooling, Effect of. Effect of the Rate of Cooling on the Magnetic and Other Properties of an Annealed Eutectoid Carbon Steel, C. Nusbaum and W. L. Cheney. U. S. Dept. of Commerce, Sci. Papers of Bur. of Standards, no. 408, Jan. 22, 1921, pp. 65-78, 11 figs.

STEEL MILLS

See Electric Drive, Steel Mills.

STRESSES

Blocks, Distribution in. Contact Pressures and Stresses, E. G. Coker, K. C. Chakko and M. S. Ahmed. Engineering, vol. 111, no. 2883, April 1, 1921, pp. 387-389, 4 figs. Stress distribution in blocks of equal breadth and depth when subjected to load over part of one edge and supported over opposite edge. (Continuation of serial.)

STRUCTURAL STEEL

Standards. Reports of the Permanent Committee of Standardization (Rapports de la commission permanente de standardisation). Mémoires et Compte rendu des Travaux de la Société des Ingenieurs Civils de France, vol. 73, nos. 10, 11 and 12, Oct.-Dec. 1920, pp. 660-718, 2 figs. Standards for and methods of testing structural steel.

SUPERHEATERS

Foster Double-Stage. Foster Patent Double-Stage Superheater. Shipbuilding & Shipping Rec., vol. 17, no. 10, Mar. 10, 1921, pp. 285-286, 3 figs. Combined flue type and smoke-tube type, giving high-superheated steam to marine engines and low-superheated steam to auxiliaries.

SWITCHBOARDS

Meter Connections. Switchboard-Meter Connections—Simple Alternating-Current Circuits, E. A. Reinman. Power, vol. 54, no. 15, April 12, 1921, pp. 576-578, 13 figs. Connections with and without instrument transformers on single-phase two and three-wire circuits. Multi-circuit ammeter and voltmeter switches for two-phase circuits.

T

TERMINALS, LOCOMOTIVE

Design. Modern Engine Terminals and Repair Shops, H. E. Stitt. Official Proc. Central Ry. Club, vol. 29, no. 2, Mar. 1921, pp. 1010-1022, 12 figs., also in Ry. Age, vol. 70, no. 13, Apr. 1, 1921, pp. 829-832, 4 figs. Successful operation of railway terminals by proper design of terminal buildings. Typical designs of locomotive terminals.

TERMINALS, MARINE

Economics. Fair Principles of Freight Rate Making and Their Effect on Our National Marine Terminal Problem, John Meigs. Gen Elec Rev, vol 24, no. 4, April 1921, pp 293-297. Economics of marine terminal organization and administration.

Mechanical-Handling Equipment. Mechanical Handling Equipment as a Means of Reducing Excessive Terminal Costs, R. R Bartlett. World Ports, vol. 9, no. 6, April 1921, pp 95-101 and (discussion) pp 101-110. Experience of port of Astoria.

TERMINALS, RAILWAY

Marquette Railroad. New Terminal Facilities for the Pere Marquette R R. Ry. Rev., vol 68, no 16, April 16, 1921, pp. 591-597, 15 figs. New freight yard. roundhouses, small repair shops, coaling stations and other facilities at New Buffalo and Plymouth, Mich.

TESTING MACHINES

Developments. Recent Developments in Testing Machines, T Y Olsen. Forging & Heat Treating, vol. 7, no. 3, Mar 1921, pp. 162-165, 10 figs. Cold bend tests, wear or slippage tests, and ductility or cupping tests. Universal efficiency-testing machine for testing tools, cutting compounds and cutting properties of tool steels. Paper read before Am. Soc. for Steel Treating

TEXTILE MACHINERY

Construction. Some Unusual Machine Operations on Textile Machinery, Ellsworth Sheldon. Am. Mach., vol. 54, no. 16, April 21, 1921, pp. 665-671, 19 figs. Methods of grinding. Cutting hardened steel blades with solft iron disk.

THEATRES

Montreal. Structural Steel Work of the Capitol Theatre, L. R. Wilson. Contract Rec., vol. 35, no. 15, April 13, 1921, pp. 359-361, 4 figs. Methods involved in erection of roof before balcony.

TIME RECORDERS

Manufacture. Manufacturing Time Recorders. Eng. Production, vol. 2, no. 24, Mar. 17, 1921, pp 353-356, 10 figs. Procedure in manufacture of National recorder at works of National Time Recorder Co., London.

TOWN PLANNING

Engineering Aspects. Town Planning and Civic Development, N. D. Wilson. Can. Engr., vol. 40, no. 12, Mar. 24, 1921, pp. 319-322 and 332. Engineering aspect of town planning. Paper read before Assn. Ontario Land Surveyors.

TRANSFORMERS

Oil. The Deleterious Effect of Fibres on the Electric Insulating Power of Oils, Thomas A. McLaughlin. Elecn., vol. 86, no. 2235, Mar. 18, 1921, pp. 325-327. Experiments on insulating power of transformer oil, and on electrical conductivity of liquid paraffin.

TUBES

Seamless. On the Manufacture of Seamless Tubes—II, Ing. Karl Gruber. Blast Furnace & Steel Plant vol. 9, no. 4, April 1921, pp. 247-252, 10 figs. German practice of seamless tube rolling, with special study of Mannesmann oblique rolling process. Translated from Stahl und Eisen.

TUNNELS

Hudson River. Tunnels. Ry. Engr., vol. 42, no. 494, Mar. 1921, pp. 111-115 and 120, 9 figs. Description of East River tunnels of Pennsylvania Railroad into City of New York.

Soft Ground. Tunneling Through Soft Ground. Robert W. Jones. Eng & Min. Jl. vol. 111, no. 15, April 9, 1921, pp. 625-626, 4 figs. Excavating for subways presents problems differing from ordinary mine drifting. Two methods, one involving use of metallic roof shielf and other depending upon timbering for needed support and protection, are described.

TYPEWRITERS

Manufacture. Routing 1600 Parts Through a Typewriter Plant, H. R. Simonds. Iron Trade Rev., vol. 68, no. 15, April 14, 1921, pp. 1031-1036, 10 figs. Practice at plant of Royal Typewriter Co., Hartford, Conn.

U

UNEMPLOYMENT

Problems of. Some of the Problems of Unemployment, Ed. C. de Segundo. Jl. Royal Soc. Arts, vol. 69, no. 3564, Mar. 11, 1921, pp. 250-262. Approximate costs of present-day unemployment. Attitude of labor. Encouragement of initiative in industry and protection of key industries.

V

VENTILATION

Tunnels. Automobile Exhaust Gases and Vehicular-Tunnel Ventilation, A. C. Fieldocr, A. A. Straub and G. W. Jones. Jl. Soc. Automotive Engrs., vol. 8, no. 4, April 1921, pp. 295-305, 10 figs. Investigation undertaken by Bur. of Mines in co-operation with New York and New Jersey State Bridge and Tunnel Commissions to determine average amount and composition of exhaust gases from motor vehicles under operating conditions similar to those that will prevail in Hudson River Vehicular Tunnel. Road tests upon 101 motor vehicles including representative types of passenger cars and trucks were conducted at Pittsburgh experiment station at Bur. of Mines.

W

WAGES

Formulas for. A Formula for Predicting Average Wage Rates. Eng. & Contracting, vol. 55, no. 12, Mar. 23, 1921, p. 270. Average wage measured in commodities is proportional to per capita efficiency of production.

Systems. Die Sinking—Bonus and Piece Work Systems, E. L. Leitch. Forging & Heat Treating, vol. 7, no. 3, Mar. 1921, pp. 165-168. Comparison of experiences with two systems.

WAREHOUSES

Storing Material. Improving Warehouse Efficiency, K. H. Lansing. Iron Trade Rev., vol. 68, no. 16, April 21, 1921, pp. 1108-1110, 7 figs. Advantages of horizontal over vertical storage of iron and steel products.

WATER POWER

British Columbia. Water Power Possibilities in the Kootenay, B.C., District, A. L. McCulloch. Contract Rec., vol. 35, no. 14, April 6, 1921, pp. 331-332, 1 fig. Horsepower available estimated at 1,400,000.

Canada. Hydro-Electric Progress in Canada During Recent Past, J. B. Challies. Elec. News, vol. 30, no. 7, April 1, 1921, pp. 33-36. 650,000 hp. completed or under construction. Active government development of power resources. Canada second only to Norway in amount developed per capita.

WASTE PREVENTION

Industrial. The Elimination of Waste in Industry. Mech. Eng., vol. 43, no. 4. April 1921, pp. 284-285. Purpose and plan of work of committee appointed by Herbert Hoover, President of Federated Am. Elng. Societies.

WATER GAS

Manufacture. Water Gas (Le gas d'eau), M. Leo Vignoo. Annales de chimie, vol. 15, no. 9, Jan.-Feb. 1921, pp. 42-60. Study of variations in combination of water gas resulting from different processes of manufacture.

WATER METERS

Testing. Testing Water Meters in Series, J. E. Garratt. Jl. Am. Water Works Assn., vol. 8, no. 2, Mar. 1921, pp. 127-131, 2 figs. Tests showed that results are the same when meters are tested singly or in series.

WATER TREATMENT

Chlorination. Water Chlorination Control by the Absorption Method, Abel Wolman. Eng. News-Rec., vol. 86, no. 15, April 14, 1921, pp. 639-641, 3 figs. Tests of Maryland State Department of Health proved that excess of residual chlorine may be used as factor of safety.

WATER WORKS

Accounting. First Report to the New England Water Works Association of the Committee on Uniform Accounting. Jl. New England Water Works Assn., vol. 35, no. 1, Mar. 1921, pp. 57-76. Special reference made to municipal works.

WELDING

Mild Steel. Specifications for Material for Welding Mild Steel. Ry. Elec. Engr., vol. 12, no. 4, April 1921, pp. 162-163. Specifications compiles for railroads by Am. Welding Soc.

Pressure Vessels. Welding pressure Vessels, Andrew Oliver. Welding Engr., vol. 6, no. 3, Feb. 1921, pp. 28-29, 4 figs., also in Acetylene Jl., vol. 22, no. 10, Apr. 1921, pp. 558-560, 4 figs. Experiments of Standard Oil Co. at Whiting, Indiana with various types of pressure vessels. Paper read before Am. Welding Soc.

Research. Progress and Needs of Welding Research and Standardization, William Spraragen. Acetylene Jl., vol. 22, no. 10, April 1921, pp. 548-554. Work being conducted by research committees of Am. Bur. of Welding.

See also Electric Welding, Arc; Oxy-Acetylene Welding.

Engineering Index

This Index is prepared by the American Society of Mechanical Engineers.

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On account of disturbances in the printing trade the section of Engineering Index from M to Z, has been held over for the August number.

A

ACCIDENTS

DUST EXPLOSIONS. An Explosion of Hard Rubber Dust, David J. Price and Hylton R. Brown. Chem. & Metallurgical Eng., vol. 24, no. 17, April 27, 1921, pp. 737-740, 5 figs. Results of investigation of recent explosion in reduction of hard-rubber scrap department of large industrial plant. Recommendations for prevention and precautions to be taken in hard-rubber grinding.

AERONAUTICS

NATIONAL ADVISORY COMMITTEE. Special Report of the National Advisory Committee for Aeronautics, Aviation, vol. 10, no. 18, May 2, 1921, pp. 553-558. Federal regulation of air navigation; air routes to cover whole U. S.; co-operation among government departments. Submitted to President of U. S., April 9, 1921.

Special Report of the National Advisory Committee for Aeronautics. Aerial Age, vol. 13, no. 9, May 9, 1921, pp. 200-202. (Concluded.)

RESEARCH LABORATORY. The Aeronautic Research Laboratory at the Institute of St. Cyr, John Jay Ide. Automotive Industries, vol. 44, no. 16, April 21, 1921, pp. 853-855, 5 figs. Facilities for aerodynamic investigations include two wind tunnels of different size, whirling arm, and two electrically operated trucks running on rails, all of which are equipped for determining characteristics of airfoils. One truck is designed for testing propellers.

TESTS. Review on Experimental Aerotechnics (Revue d'aérotechnique expérimentale), L. Toussaint. Revue générale des Sciences, vol. 32, no. 7, April 15, 1921, pp. 203-213, 2 figs. Aerodynamic principles experimentally established at principal aeronautical laboratories of the world.

NAPIER "CUB". The Napier "Cub" Engine. Automobile Engr., vol. 11, no. 149, April 1921, pp. 146-147, 2 figs. Four sets of four cylinders. Included angle between uppermost blocks of cylinders is 52 ½ deg. and between bottom blocks 127 ½ deg. Engine develops 1000 hp.

OPERATION WITH AUTOMOBILE GASOLINE. Operating Liberty "12" and Wright-Hispano 300-hp. Engines on Automobile Gasoline. U. S. War Dept., Air Service Information Circular, vol. 3, no. 227, May 10, 1921, 4 pp. It is recommended that use of such fuel in engines should be avoided whenever possible and in cases of necessity engines should be run throttled while on or near ground.

PERFORMANCE. Investigation of the Effect of Air Conditions Upon the Power of Aviation Engines, Harold S. White. Armour Engr., vol. 12, no. 3, Mar. 1921, pp. 135-144, 3 figs. Investigations of theory establishing that power is proportional to density or inversely proportional to absolute temperature. Development of new theory.

Some Factors of Airplane Engine Performance, Victor R. Gage. Nat. Advisory Committee for Aeronautica, Report No 108, 1921, 29 pp., 28 figs. Tests on Liberty 12 and three models of Hispano-Suiza made in altitude chamber where conditions simulated altitudes up to about 30,000 ft. at engine speeds ranging from 1,200 to 2200 r.p.m.

POWER AT HIGH ALTITUDES. Influence of Flight at High Altitudes on Power of Aeroplane Engines (Influence du vol à haute altitude sur la puissance du moteur d'un aéroplane), M. Collette. Arts et Métiers, vol. 74, no. 2, Feb. 1921, pp. 49-51, 4 figs. Graph for determining altimetric reduction of power of aeroplane engines from temperature and barometric pressure.

AEROPLANE PROPELLERS

DESIGN. Aeronautic Propeller Design, F. W Caldwell. Jl. Soc. Automotive Engrs., no. 8, no. 5, May 1921, pp. 467-480, 26 figs. Propeller-design theories and aerodynamic principles are discussed mathematically, as well as elements governing best propeller diameter for obtaining highest thrust. Consideration is given in detail to adjustable-pitch and reversible propellers as well as to those made up of laminations or sheets of paper or fabric impregnated with bakelite as binder.

AEROPLANES

AEROFOILS. Aerodynamic Characteristics of Aerofoils. Nat. Advisory Committee for Aeronautics, report no. 93, 1921, 83 pp., 218 figs. Collection of data on aerofoils from published report of leading aerodynamic laboratories of U. S. and Europe. Charts and tables for use of designing engineers and for general reference.

The German Lachmann Slotted Aerofoil. Flight, vol. 13, no. 14, April 7, 1921, pp. 242, 2 figs. Translated from Flugsport.

The Resistance of Aerofoils, W. F. Gerhardt Aerial Age, vol. 13, no. 8, May 2, 1921, pp. 175-178, 13 figs. Methods of plotting aerofoil characteristics. (Concluded.)

ALL-METAL. German All-Metal Commercial Machines, Alfred Gradenwitz. Aeronautics, vol. 20, no. 394, May 5, 1921, pp. 314-316, 5 figs. Dornier types.

The New German All-Metal Aeroplanes (Les nouveaux avions métalliques allemands), E. H. Lémonon. Aerophile, vol. 29, nos. 5-6, Mar. 1-15, 1921, pp. 71-78, 16 figs. Junkers types.

DESIGN. Influence of Span and Load Per Square Meter on the Air Forces of the Supporting Surface, A. Betz. Aerial Age, vol. 13, no. 10, May 16, 1921, pp. 224-225, 4 figs. Formulas. Translated from Technische Berichte.

Load Factors. Aeronautics, vol. 20, no. 391, April 14, 1921, pp. 254-255. Scale of load factors and factors of safety prepared by British Advisory Committee for Aeronautics.

FLIGHT ENDURANCE. Notes on Airplane Flight Endurance. U. S. War Dept., Air Service Information Circular, vol. 3, no. 210, May 1, 1921, 6 pp., 1 fig. Chart for determining minimum horsepower required or maximum horsepower available at any altitude that aeroplane can reach.

STRUTS. The Design of Long Struts Exposed to the Air, John Case. Aeronautics, vol. 20, nos. 391 and 392, April 14 and 21, 1921, pp. 257-258, 4 figs., and 272-274, 5 figs. Apr. 14: formulas for computing dimensions of different types. Apr. 21: Method of designing taper struts having parallel bole.

See also Helicopters; Parachutes, Seaplanes.

AIRSHIPS

GERMAN Development and Present Status of German Airships. Automotive Industries, vol. 44, no. 20, May 19, 1921, pp. 1057-1065, 1 fig. Tables giving characteristics of German airships built up to May 1921. Survey of technical successes and failures of various types. Comparison of performance of R-34 with that of German L-59 which made trip to East Africa.

Hangars. *See Hangars.*

Mooring Gear. Airship Mooring Gear Engineering, vol. 111, no. 2884, April 8, 1921, pp. 423-424 and 426, 4 figs. Experimental mooring mast designed and installed by British Air Ministry.

R-36. The Passenger-Carrying Airship R-36. Engineering, vol. 121, no. 2885, April 15, 1921, pp. 454-456 and 458, 28 figs., partly on supp. plate. Characteristics: Overall length, 672 ft. 2 in.; maximum diameter of hull, 78 ft. 9 in.; height from bumping bags to top of hull structure, 91 ft. 7 in.; gas capacity, 2,196,000 cu. ft.; carried in 19 bags; gross lift, 64.5 tons.

See also Aerodromes.

ALCOHOL

Coke-Oven Gas. The Manufacture of Alcohol from Coke-Oven Gas, C. F. Tidman. Jl. Soc. Chem. Industry, vol. 40, no. 8, April 30, 1921, pp. 86T-89T, 2 figs. Record of work carried out at Skinningrove Iron Works, England.

Industrial. Industrial Alcohol (L'alcool industriel), Charles Blanchet. Revue de l'Ingénieur et Index technique, vol. 28, no. 4, April 1921, pp. 179-185. Requirements for manufacture of industrial alcohol. Possibility of utilizing alcohol as automobile fuel. (To be continued.)

ALLOY STEELS

Chromium-Tungsten. Coustitution of Chromium: Tunsten Steels. Chem. & Metallurgical Eng., vol. 24, no. 18, May 4, 1921, pp. 791-793, 8 figs. Recent Japanese work throwing light upon complex reactions giving self-hardening and red-hardness properties to modern high-speed steels. From Sci. Reports of Tohoku University.

ALLOYS

See Aluminum Alloys; Zinc Alloys; Bearing Metals; Bronzes; Copper Alloys; Gun Metal; Phosphor Bronze.

ALUMINUM

Casting Losses. Losses in Aluminum and Aluminum-Alloy Melting, Robert J. Anderson, U. S. Dept. of Interior, Bur. of Mines, Reports of Investigations, no. 2239, April 1921, 6 pp. Factors in operation of furnaces that affect casting losses.

ALUMINUM ALLOYS

Melting Practice. Iron-Pot Melting Practice for Aluminum Alloys, Robert J. Anderson. Metal Industry (N.Y.), vol. 19, no. 5, May 1921, pp. 189-190. Design of iron-pot furnaces.

AMMONIA CONDENSERS

Selection. The Proper Selection of Ammonia Condensers, W. H. Motz. Power, vol. 53, no. 17, April 26, 1921, pp. 659-662, 4 figs. Economic considerations.

ANEMOMETERS

Comparison of. Comparison of Anemometers (Sur la comparabilité des anémomètres), M. C.-E. Brazier. Comptes rendus des Séances de l'Académie des Sciences, vol. 172, no. 14, April 4, 1921, pp. 843-845. Comparison of various types in currents of air inclined at an angle.

APPRENTICES, TRAINING OF

Methods. Programs of Apprenticeship and Special Training in Representative Corporations—XII, J. V. L. Morris. Am. Mach., vol. 54, no. 18, May 5, 1921, pp. 778-779, 4 figs. Method of training apprentices at plant of Packard Motor Car Co., Detroit, Mich.

National Instructional Factories. Industrial Training. Times Eng. Supp., no. 558, April 1921, p. 132. Discusses organization of national instructional factories for training and education industrial apprentices.

Railways. Paris-Orleans Apprentice Work Organized. Ry. Mech. Engr., vol. 95, no. 5, May 1921, pp. 313-316, 4 figs. Description of development of courses for apprentices of Paris-Orleans during war. Translated from Revue Générale des Chemins de Fer.

ARMATURES

Heat Flow in Coils. Longitudinal and Transverse Heat Flow in Slot-Wound Armature Coils, Carl J. Fechheimer. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 5, May 1921, pp. 421-430, 9 figs. Calculations of equations and test results.

AUTOMOBILE ENGINES

Carburetors. *See Carburetors.*

Highway. Non-Detachable Head Used in New Stock Engine, J. Edward Schipper. Automotive. Industries, vol. 44, no. 16, April 21, 1921, pp. 844-846, 4 figs. Engine manufactured by Highway Engine Co. has four cylinders, 3¾ by 5 in., and develops maximum of 48 hp. Both halves of crankcase and water-jacket cover are aluminum castings. Valve caps are screwed into cylinder head. Full pressure lubrication employed.

AUTOMOBILE FUELS

Characteristics. The Character of Various Fuels for Internal Combustion Engines—III, H. T. Tizard and D. R. Pye. Automobile Engr., vol. 11, no. 149, April 1921, pp. 134-137, 2 figs. Influences of specific heat and dissociation of working fluid. Calculation of final temperature and work done during expansion.

Research. Résumé of Bureau of Standards Fuel Study, H. C. Dickinson. Jl. Soc. Automotive Engrs., vol. 8, no. 5, May 1921, pp. 482-486, 6 figs. Two types of experiments were undertaken; steady runs to determine rate of fuel consumption under load conditions, at about one-fifth maximum mean effective pressure and speed of 1200 r.p.m., and series of repeated accelerations from 10 to about 30 m.p.h. In each case fuel consumption was recorded.

The Influence of Various Fuels on Engine Performance—II and III, H. R. Ricardo. Automotive Industries, vol. 44, nos. 16 and 19, April 21 and May 12, 1921, pp. 856-862, 6 figs., and 1003-1007, 12 figs. Research on detonation and effect thereon of combustion chamber design, turbulence, speed of rotation, temperature and pressure are discussed at length, and measurement of value of fuel in terms of its tendency to detonate are tabulated and plotted in their relation to other important factors.

The Influence of Various Fuels on the Performance of Internal Combustion Engines—III and IV, H. R. Ricardo. Automobile Engr., vol. 11, nos. 149 and 150, April and May 1921, pp. 130-133, 5 figs., and 169-175, 14 figs. April: Experimental study of relationship between detonation point and spontaneous ignition temperature. May: Experimental investigation of power output from different fuels, with constant and with adjusted compression ratios.

See also Alcohol.

AUTOMOBILES

Bodies. Automobile Body Construction, P. E. Stone. Jl. Soc. Automotive Engrs., vol. 8, no. 5, May 1921, pp. 404-409. Notes on strength and desirability of materials suitable for construction of enclosed type of body.

AVIATION

Canadian Air Board. Report of the Canadian Air Board for the Year 1920. Flying, vol. 10, no. 4, May 1921, pp. 139-143. Board was created (1) to regulate civil aviation, (2) to conduct civil government operations, and (3) to develop air defense of Canada, including organization and administration of Canadian Air Force.

Commercial. European Air Lines, Aeronautica, vol. 20, no. 395, May 12, 1921, pp. 332-334, 6 figs. Air routes which are now in operation in Europe, with fare tariffs and timetables.

Landings, Marking. Air Service Adopts Location Marker. Aviation, vol. 10, no. 17, April 25, 1921, p. 527, 2 figs. Specifications of locations marker adopted by U. S. Air Service.

Mail Service. Three Years of Air Mail Service Aviation, vol. 10, no. 18, May 2, 1921, pp. 559-564, 5 figs. Comparison of performance of U. S. Air Mail Service and of British and Canadian civil flying.

National Advisory Committee for Aeronautics. Special Report of the National Advisory Committee for Aeronautics. Aerial Age, vol. 13, no. 8, May 2, 1921, pp. 178-180. Federal regulation of air navigation. Air routes to cover whole U. S. Co-operation among government departments.

B

BEAMS

Curved. The Approximate Solution of Problems of Stability in Space by Means of the Funicular Polygon. (Ueber die angenaherte Lösung von Stabilitätsproblemen im Raum mittels der elastischen Gelenkkette), Heinrich Hencky. Eisenbau, vol. 11, no. 24, Dec. 21, 1920, pp. 437-452, 12 figs. In view of fact that there is apparently no solution on hand for determination of the stability of curved beams, writer attempts to develop an approximative method with which problem can at all times be numerically solved.

Reinforced-Concrete. Curves for Design of Beams and Slabs, C. N. Haggart. Concrete, vol. 18, no. 5, May 1921, pp. 235-236, 2 figs. Diagram for determining dimensions for reinforcing steel.

BEARING METALS

Anti-Friction. Anti-Friction Bearing Metals, P. W. Priestley. Metal Industry, (Lond.), vol. 18, no. 17, April 29, 1921, pp. 323-324. Typical compositions of anti-friction methods employed in construction of aeroplanes and automobile engines.

Research. Results of Investigation Covering Bearing Metals. Belting, vol. 18, no. 4, April 1921, pp. 63-64. Report of committee on mechanical standards, Canadian Pulp & Paper Assn., at recent Montreal convention.

BEARINGS

Examination. A Microphone "Stethoscope" for Bearings. Engineering, vol. 111, no. 2888, May 6, 1921, pp. 546, 3 figs. Apparatus for examining condition of bearings and gears by electricity.

BEARINGS, BALL

Manufacture. The Ball Bearing—I, Henry L. Heathcote. Machy. (Lond.), vol. 18, no. 448, April 28, 1921, pp. 114-119, 3 figs. Notes on manufacture and testing.

BEARINGS, ROLLER

Manufacture. Maintaining Continuity Throughout Roller Bearing Manufacture, J. Edward Schipper. Automotive Industries, vol. 44, no. 17, April 28, 1921, pp. 912-917, 22 figs. Methods used at plant of Timken Roller Bearing Co., Canton, Ohio.

BLAST-FURNACES GAS

Cleaning. Notes on the Cleaning of Blast Furnace Gas, S. H. Fowles. Engineering, vol. 111, no. 2880, May 13, 1921, pp. 600-602, 7 figs. Methods of operating Halberg-Beth dry gas cleaning plant. (Abstract). Paper read before Iron & Steel Inst.

BLAST FURNACES

Charging. Husson Incline System of Charging Materials Into Blast Furnaces (Monte-charge incliné système "Husson" pour haut-fourneau), M. H. Barral. Revue de Métallurgie, vol. 18, no. 2, Feb. 1921, pp. 92-95, 9 figs. Modification of Stachler system.

Design. Stack Changes Effect Economy, H. R. Stuyvesant. Iron Trade Rev., vol. 68, no. 19, May 12, 1921, pp. 1312-1313 and 1316, 3 figs. Improvements in cooling equipment, lines and hearth of Alabama blast furnace, together with introduction of casting machine and new trestle.

BLOWING ENGINES

Gas-Driven. 13 H.P. Gas Driven Blowing Engine, Engr., vol. 131, no. 3409, April 29, 1921, pp. 451-454, 4 figs., partly on supp. plate. Engines manufactured at Galloway Works, Manchester, England.

BOILER FEEDWATER

Analyses. The Interpretation of Boiler-Water Analyses, J. R. McDermet. Mech. Eng., vol. 43, no. 5, May 1921, pp. 319-320 and 342. Limitations and applications of technical or mineral analysis. Use of partial sanitary analysis as forecasting possible trouble due to pollution. Significance of analysis for dissolved gases in relation to conditions under which is used.

BOILER FIRING

Pulverized Coal. Economical Firing of Steel Plant Boilers, Charles Longenecker. Blast Furnace & Steel Plant, vol. 9, no. 5, May 1921, pp. 308-310 and 336. Comparison of hand-fired stoker-fired and pulverized-coal-fired boilers. Test run on 520-hp. boiler fired by pulverized coal.

BOILER INSPECTION

Canada. Rules Governing the Inspection of Railway Stationary Boilers in Canada. Boiler Maker, vol. 21, no. 5, May 1921, pp. 137-138. Rules of Board of Railway Commissioners for Canada.

BOILER OPERATION

Losses. The Cost of Boiler Scale, W. F. Schaphorst. Ry. Mech. Engr., vol. 95, no. 5, May 1921, pp. 292, 1 fig. Chart for determining loss due to scale.

Settings. Constructing Horizontal Boiler Settings, H. E. Dart. Boiler Maker, vol. 21, no. 5, May 1921, pp. 127-131, 5 figs. Typical setting designs adopted as standard by Hartford Steam Boiler Inspection and Insurance Co.

BOILERS, WATER TUBE

Stirling. Development of the Stirling Boiler. Power, vol. 53, no. 16, April 19, 1921, pp. 632-634, 7 figs. Recent modifications making for standardizition of classes, greater accessibility, elimination of priming and improved setting.

Tests. Boiler Tests with Pulverized Illinois Coal, Henry Kreisinger and John Blizard. Mech. Eng., vol. 43, no. 5, May 1921, pp. 321-322 and 326, 2 figs. Tests of 468-hp. water-tube boiler fired with pulverized Illinois coal. Results showed that, contrary to customary specification, it is not necessary to pulverize coal to extreme finess of 85 per cent through 200-mesh screen. Best results were obtained when coal was burned at rates from 0.5 lb. to 2 lb. per cu. ft. of combustion space per hour.

BRAZING

See Aircraft Construction Materials, Brazing.

BRICK

Sewer. Report of Committee C-3 on Brick. Am. Soc. for Testing Matls., advance paper, 7 pp., 2 figs. Proposed tentative specifications for clay sewer brick.

BRIDGES, RAILWAY

Classification. Systematic Classification of Old Bridges, C. F. Loweth. Eng. & Contracting, vol. 55, no. 17, April 27, 1921, pp. 420-422, 3 figs. Practice of Chicago, Milwaukee & St. Paul Railroad. Paper read before Western Soc. of Engrs.

Design. Evolution of Bridge Design, Charles Evans Fowler. Jl. Western Soc. of Engrs., vol. 25, no. 15, Nov. 1920, pp. 574-591, 8 figs. Survey of developments in design and construction of railway bridges in U. S.

BROACHING

Keyways. Guide Bushings for Keyway Broaching. Machy. (Lond.), vol. 18, no. 447, April 21, 1921, pp. 75-76, 3 figs. Formulas for designing bushings for broaching accurate keyways.

BUILDING

Concrete. Effect of High Temperature Fire on Concrete Building. Eng. News-Rec., vol. 86, no. 18, May 5, 1921, pp. 760-763, 7 figs. Burning naphthalin fused the concrete and wrecked structure of Barrett Mfg. Co. at Frankford, Pa. Greatest damage due to collapse of steel monitors.

BUILDING CONSTRUCTION

Concrete. Putting Up a Concrete Building Under Severe Difficulties, H. C. Paddock. Contract Rec., vol. 35, no. 16, April 20, 1921, pp. 383-385, 7 figs. Fish-freezing plant on island of St. Pierre erected on rocky site. Materials and labor imported. Fire of extreme severity destroyed concrete and necessitated partial rebuilding.

C

CAR WHEELS

Tire-Firing Rolls. Tire Firing Rolls for Railway Wheels. Engr., vol. 131, no. 3408, April 22, 1921, pp. 441, 3 figs. Hydraulic press manufactured by B. & S. Massey, Openshaw, Manchester.

Jet Calibration. Calibrating Carbureter Jets in Quantity by Actual Flow Measurement, J. Edward Schipper. Automotive Industries, vol. 44, no. 18, May 5, 1921, pp. 958-959, 3 figs. Apparatus used by Zenith Carburetor Co. consists of tank with constant head, device for holding jet, electrically controlled timing elements, and graduates for measuring volume of flow in unit time. Each operator can test 160 jets per hour by use of one calibrating machine.

Research. Experimental Research on the Best Proportion of Fuel and Air for Explosive Motors (Recharches expérimentales sur les valeurs du titre, en essence, du mélange d'alimentation des moteurs à explosion), J. Boudet. Arts et Métiers, no. 3, Dec. 1920, pp. 49-54, 7 figs. Comparative study of various types of carburetors.

CARS

Steel. Progress in the Development of the All-Steel Car, J. J. Tatum, Ry. Rev., vol. 68, no. 19, May 7, 1921, pp. 699-700. Advisability of using copper bearing steel for improving performance from stand point of service and maintenance. Paper read before Can. Ry. Club.

CARS, FREIGHT

Draft-Gear Tests. Draft Gear Tests of the Railroad Administration. Ry. Mech. Engr., vol. 95, no. 5, May 1921, pp. 301-304, 1 fig. Results from gears after three years' service; destructive tests and rivet-shearing tests.

Steel. Repairs of Maintenance of Steel Freight Cars, S. Lynn. Can. Ry. Club, vol. 20, no. 3, Mar. 8, 1921, pp. 24-32. Outline of practice, with notes on experience of Pittsburgh and Lake Erie Railroad.

CARS, REFRIGERATOR

Design. A System of Transit Refrigeration and Heating, Lewis Penwell. A.S.R.E. Jl. vol. 7, no. 2, Sept. 1920, pp. 140-150, 2 figs. Equipment for refrigerating railway cars.

CAST IRON

Research. The Co-operation of Scientific and Industrial Research in the Iron Foundry—II, Thos., Vickers. Foundry Trade Jl., vol. 23, no. 242, April 7 1921, pp. 316-319. Scope of British Cast Iron Research Assn. (Concluded.)

CASTINGS

Blowers. Rigging for Speed in Blower Work, Herbert R. Simonds. Foundry, vol. 49, no. 9, May 1, 1921, pp. 359-363, 8 figs. Castings for forced-draft blower manufactured by Coppus Eng. & Equipment Co., Worcester, Mass.

Non-Ferrous. Non-Ferrous Castings in Spinning Molds, Louis J. Josten. Iron Age, vol. 107, no. 20, May 19, 1921, pp. 1289-1292, 4 figs. Casting of non-ferroua bands by centrifugal casting machine at works of George C. Clark Metal Products Co., Detroit.

CEMENT, PORTLAND

Specifications. Portland Cement, R. E. Stradling. Concrete, vol. 16, no. 4, April 1921, pp. 223-233, 10 figs. Comparison of British, American, French and German specifications and methods of testing. (Concluded.)

Testing. Judging the Quality of Portland Cement, R. J. Colony. Eng. World, vol. 18, no. 5, May 1921, pp. 331-334, 8 figs. Triangular concentration diagram constructed from results obtained in analyses made in laboratory of Board of Water Supply of the City of New York. Paper read before Am. Inst. Min. and Metallurgical Engrs.

CHAINS

Manufacture. The Manufacture of Driving Chains. Eng. Production, vol. 2, no. 32, May 12, 1921, pp. 603-610, 22 figs. Procedure at works of Hans Renold.

CHIMNEYS

Reinforced-Concrete. Diagram for Designing Reinforced Concrete Chimneys, F. E. Hertel. Eng. News-Rec., vol. 86, no. 19, May 12, 1921, pp. 803-804, 3 figs. Graph for determination of coefficient of formulas.

CHRONOMETERS

Devolopments. Latest Developments in Chronometry (Les derniers progrès de la chronomètrie), Léopold Reverchon. Nature (Paris), no. 2450, Mar. 19, 1921, pp. 177-181, 10 figs. Guillaume balancing wheel for marine chronometer

COAL

Analysis. The Analysis of Coal, S. Roy Illingworth. Colliery Guardian, vol. 121, no. 3146, April 15, 1921, pp. 1094-1095, 4 figs. Determination of proximate analysis of coal. From book by same writer soon to be published by Colliery Guardian Co.

Briquetting. Factors to be Borne in Mind in Making Briquets of Fine Materials, J. E. Stevens. Coal Age, vol. 19, no. 15, April 14, 1921, pp. 663-666, 5 figs. Methods of briqueting coal and peat.

Sulphur, Analysis. The Analysis of Sulphur Forms in Coal, Alfred R. Powell. U. S. Dept. of Interior, Bur. of Mines, technical paper 254, 1921, 21 pp. 1 fig. The applicability of method of Powell and Parr to various kinds of coal. Method was found to give correct and accurate results for analysis of sulphur forms in coal.

COAL BREAKERS

Design. Preparation Methods Susquehanna Has Built Into Reconstructed Pennsylvania Breaker. Coal Age, vol. 19, no. 14, April 7, 1921, pp. 618-622, 4 figs. Jigs are placed stepped down like stairway, using single chute for feed and another for discharge. "Rock" from jigs is screened and hand-picked for clean coal of size just washed, undersize going to condemned-coal conveyor for retreatment.

COAL WASHING

Methods. Method of Washing Coal for Metallurgical Coke at Risco, in Birmingham Field, E. P. Stewart. Coal Age, vol. 19, no. 18, May 5, 1921, pp. 807-810, 5 figs. Coal crushed to 1 in. and under, jigged and delivered at steel plant with only 6 per cent. moisture without use of drainage tanks or centrifugal driers. Water clarified for reuse contains only 0.15 per cent solids.

Washing Coal With Air Instead of With Water, L. E. Woods. Coal Age, vol. 19, no. 18, May 5, 1921, pp. 810-812, 4 figs. Air forced upward through table deck and its load of material almost immediately, separates light from heavy particles. Machine has large capacity and product is dry.

COKE HANDLING

Plants. Coke Handling System at Lawrence, Mass., H. B. Mosley. Am. Gas Jl., vol. 114, no. 20, May 14, 1921, pp. 421-422 and 433, 6 figs. Plants for handling sizing and storing coke.

COLUMNS

Steel. Comparison of Formulas for Steel Columns, N. Barnes Hunt. Machy. (N. Y.), vol. 27, no. 9, May 1921, pp. 852-854, 4 figs. Graphs of a number of familiar formulas prepared for allowable unit stress of 12,000 lb. per sq. in. in accordance with recommendation of Am. Soc. Civil Engrs.

COMPRESSED AIR

Mines. The Production and Transmission of Compressed Air in Mines, John T. Pringle. Trans. of North of England Inst. of Min. & Mech. Engrs., vol. 71, part 2, Feb. 1921, pp. 24-39 and (discussion) pp. 39-42, 9 figs. Also in Trans. Inst. Min. Engrs., vol. 60, part 2, Jan. 1921, pp. 146-151 and (discussion) 151-164, 9 figs. Requirements of compressors. Performance of Ingersoll type.

CONCRETE

Alkali Action on. Engineering Investigations, E. C. Bebb, U. S. Dept. of Int. Reclamation Rec., vol. 12, no. 5, May 1921, pp. 224-227, 3 figs. Progress in investigation of alkali action on concrete.

Developments. Recent Developments in Concrete Monthly Bul. Can. Inst. Min. & Metallurgy, no. 109, May 1921, pp. 410-437, 16 figs. Survey of recent researches at representative institutions.

Proportioning Aggregates. A Logical Scheme for Determining the Concrete Making Value of Available Aggregates and Its Practical Application to the Production of Concrete of Pre-Determined Quality in the Field, G. M. Williams. Jl. Eng. Inst. of Canada, vol. 4, no. 5, May 1921, pp. 301-308, 6 figs. Investigation of current theories of proportioning concrete, and account of field tests.

CONDUITS

Wood. Wooden Conduits Under Pressure (Conduites forcées en bois), M. Cazaubielh. Nature (Paris), no. 2451, Mar. 26, 1921, pp. 203-206, 7 figs. Norwegian designs.

CONNECTING RODS

Manufacture. Making Motor-Car Engine Connecting Rods. Machy. (Lond.), vol. 18, no. 447, April 21, 1921, pp. 65-69, 11 figs. Machines and fixtures used for drilling, boring, milling, grinding, reaming and gaging operations.

COOLING TOWERS

Types. Water Cooling Towers—II, I. V. Robinson. Beama, vol. 8, no. 4, April 1921, pp. 346-353, 4 figs. Comparative study of different types.

COPPER ALLOYS

Heat Treatment. Heat Treatment of Copper Alloys, J. S. Glen Primrose. Metal Industry (Lond.), vol. 18, no. 15, April 15, 1921, pp. 281-286, 6 figs. Effect of heat treatment upon finer properties. Paper read before Instn. British Foundrymen.

COLD STORAGE

Plant Design. Antwerp's Government Cold Stores. Cold Storage, vol. 24, no. 277, April 21, 1921, pp. 97-99, 3 figs. Refrigeration is effected by mixed system of direct expansion through pipes suspended from ceiling and ventilation from two powerful air-circulating batteries.

COST ACCOUNTING

Machine-Tool Industry. Cost Accounting for the Machine Tool Builder. Am. Mach., vol. 54, no. 17, April 28, 1921, pp. 726-731, 1 fig. Report of Scoven, Wellington & Co. to National Machine Tool Builders Assn.

COSTS

Industrial. A Comparison of Pre-War and Post-War Production Costs in Engineering, R. J. A. Pearson. Engineering, vol. 111, no. 2887, April 29, 1921, pp. 537-540. Application of mathematical methods to investigate financial and industrial situations. Paper read before Royal Statistical Soc.

CUPOLAS

Design. Design of Cupola and Accessory Areas, Y. A. Dyer. Iron Age, vol. 107, no. 20, May 19, 1921, pp. 1313-1314 and 1347-1348, 1 fig. Ratios of tuyère to cupola and blast-pipe area; bustle pipe to blast pipe and tuyère areas. Height related to economic conditions.

CRANES

Traveling. Designing Traveling Cranes with Regard for Safe Operation, Nicolaas Prakken. Am. Mach., vol. 54, no. 18, May 5, 1921, pp. 761-765, 10 figs. Typical safety appliances.

CUTTING TOOLS

Cutting Speeds. Cutting Speeds for Steel and Cast-Iron. Belting, vol. 18, no. 4, April 1921, pp. 72. Tables showing cutting speeds.

Diamond. The Diamond as a Cutting Tool. Engr. Production, vol. 2, no. 29, April 21, 1921, pp. 521-523, 10 figs. Its application in production work.

D

DIE CASTING

Methods. Die-Casting Methods and Metals—II and III, M. H. Potter. Foundry, vol. 49, nos. 9 and 10, May 1 and 15, 1921, pp. 342-344, 2 figs., and 404-406, 4 figs. Data regarding various metals and alloys which may be die cast are given and comparison is made between results from casting in sand and in dies. Methods of placing inserts in die castings. Details of cleaning baths and electroplating process.

DIESEL ENGINES

Marine. The Sulzer Marine Diesel Engines. Practical Engr., vol 63, no 1782, April 21, 1921, pp. 244-247, 3 figs. Efficiency curves of two-cycle and four-cycle engines.

Standardized. Standardized Diesel Engines—III, H R Sets. Mar. Eng., vol 26, no. 5, May 1921, pp 391-392, 1 fig. Description of valve-in-head method of scavenging for two-cycle type engine.

DROP FORGINGS

Heat Treatment. The Heat Treatment of Drop Forgings, Leslie Aitchison. Forging & Heat Treating, vol. 7, no. 5, May 1921, pp. 255-264, 6 figs. Influence of alloying elements on hardening. Mechanical effects of heat treatment.

Steel Castings vs. Drop Forgings Replace Steel Castings, F. B. Fairbanks. Forging & Heat Treating, vol. 7, no. 4, April 1921, pp. 214-215, 3 figs. Claims forgings provide product of superior strength, toughness and resistance to shock and wear at lower cost.

E

ELECTRIC DRIVE

Steel Mills. The Steel-Mill Frequency Problem, B. G. Lamme. Elec. World, vol. 77, no. 17, April 23, 1921, pp. 921-923, 1 fig. Six general methods are pointed out for economically using 60-cycle purchased energy in plant with 25-cycle equipment.

ELECTRIC FURNACES

Electrode Economizers. Economizer Reduces Heat Dissipation, Frank Hodson. Iron Trade Rev., vol. 68, no. 17, April 28, 1921, pp. 1180-1181, 2 figs. Type of cooling ring or electrode economizer manufactured by Elec. Furnace Construction Co., Phila. Discussion presented at meeting of Am. Electrochemical Soc.

Foundries. Acid vs. Basic Electric Furnace for the Foundry, F. W. Brooke. Chem. & Metallurgical Eng., vol. 24, no. 18, May 4, 1921, p. 791. Uses to which each type is best suited.

Smothered-Arc. Electric Furnaces for Melting Non-Ferrous Metals. Chem. & Metallurgical Eng., vol. 24, no. 18, May 4, 1921, p. 793, 1 fig. Type recently brought out by Gen. Elec. Co.

Steel Manufacture. Electric Furnaces for Making Steel—III, Alfred Stansfield. Blast Furnace & Steel Plant, vol. 9, no. 5, May 1921, pp. 324-327 3 figs. General feature and advantages of arc furnace and resistance furnace. Operating features of electric furnaces.

ELECTRIC GENERATORS, A.C.

Heat Losses. Heat Losses in the Conductors of Alternating-Current Machines, Waldo V. Lyon. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 5, May 1921, pp. 398-410, 8 figs. Derivation of formulas.

ELECTRIC LOCOMOTIVES

Developments. Review of Recent Large Electric Locomotives, A. Laternser. Elecn. (Lond.), vol. 86, no. 2243, May 13, 1921. pp. 584-586, 6 figs. Comparative data of recent American and European electric locomotives. Translated from Schweizerische Bauzeitung.

Steam vs. Characteristics of the Electric Locomotive. Ry. Elec. Engr., vol. 12, no. 5, May 1921, pp. 195-200, 8 figs. Advantages of electric locomotive over steam locomotive. Paper read before Franklin Inst.

ELECTRIC MOTORS, A.C.

Commutator. The Theory of the Three-Phase Variable Speed Shunt Commutator Motor, J. L. D. Riesdale. Elecn., vol. 86, no. 2240 and 2242, April 22 and May 6, 1921, pp. 478-481 and 546-548, 11 figs., 6 figs. Theory of operation of commutator. Shunt motor with compensating winding.

ELECTRICAL MACHINERY

Synchronous Machines. Essential Design Data for Choosing Synchronous Machines, Theo. Schou. Elec. World, vol. 77, no. 19, May 7, 1921, pp. 1033-1037, 20 figs. Curves illustrating effect of Kva. rating and speed on weight and efficiency of synchronous machines.

ELECTRIC PLANTS

Interconnection. Limitations of Interconnection, E. C. Stone. Elec. World, vol. 77, no. 18, April 30, 1921, pp. 990-991. Rupturing capacity of oil switches under short-circuit conditions limits interconnection unless pants are well distributed.

ELECTRIC RAILWAYS, TRACK

Rail Bonding. Welding Rail Bonds by Oxy-Acetylene, A. S. Kinsey. Ry Signal Engr., vol 14, no 5, May 1921, pp 194-196, 4 figs. Discussion of adaptability of this method with directions for its use and its application to rail bonding.

ELECTRIC TRANSMISSION LINES

Design. Economical Design of a Transmission Line, Ryotaro Mitsuda. Researches of Electrotechnical Laboratory, no. 79, Sept 1919, 212 pp., 137 figs. Equations for determining most economical voltage of transmission, size of conductors and spacing of towers.

High-Voltage. French Transmission Line for 100 Kv., M. A. Henriod. Elec. World, vol. 77, no 18, April 30, 1921, pp. 982-985, 12 figs. Transmission of energy at 110,000 volts over 115 miles of mountains and wooded country.

220,000-Volt. 220,000-Volt Transmission Progress, John A. Koontz. Jl Electricity & Western Industry, vol. 46, no. 10, May 15, 1921, pp 477-479, 9 figs. Report of Engineering Sub-Committee to the Pacific Coast Division of National Electric Light Association. It is concluded from laboratory research that the most logical scheme for developing a 220,000-volt insulator "seems to be that of utilizing the present 10-in. unit*** but providing means to properly take care of the voltage distribution throughout the string*** when more than eight or nine units are used."

ELECTRIC WELDING, ARC

Boiler Shells. The Electric Welding of a Corroded Boiler-Shell, A. Kenneth Dawson. Trans. of North of England Inst. of Min. & Mech. Engrs., vol. 71, part 1, Dec. 1920, pp. 8-12, 2 figs. Repairing corroded Lancashire boiler by use of portable electric-arc welding apparatus.

Heat Treatment of Welds. Effect of Heat Treatment on Nitride in Metal Arc Welds, James W. Owens, J. H. Ramage and J. A. Watts. Welding Engr., vol. 6, no. 4, April 1921, pp. 23-27, 16 figs. Experiments indicated that heat treatment to which deposited metal has been subjected determines form of nitride in metal, and that form in which nitride exists has very decided effect upon physical properties of metal. Paper read before Am. Welding Soc.

EMPLOYEES REPRESENTATION

Shop Committee. Employe Representation in Management, R. L. Wilson. Textile World, vol. 49, no. 18, April 30, 1921, pp. 117-119. Shop committees organized by East Pittsburgh plant of Westinghouse Elec. & Mfg. Co.

ENGINEERING SOCIETIES

Organization. On the Organization of an Engineering Society, Morris Llewellyn Cooke. Mech. Eng., vol. 43, no. 5, May 1921, pp. 323-325 and 356.

EYEBOLTS

Strength. The Mechanical Qualities Required in Eyebolts: With Some Consideration of the Izod Test, in its Relation to the Question of Brittleness in Mild Steel, R. T. Rolfe. Jl. Instn. Mech. Engrs., no. 3, April 1921, pp. 177-189, 4 figs. partly., on supp. plate. From consideration of results found in experimental investigation it is suggested that carbon content of steel should be 0.34 per cent, and Izod figure not less than 25 ft.-lb.

F

FANS

Electric Drive. Motor Drive for Fans and Blowers, Gordon Fox. Power, vol. 53, no. 17, April 26, 1921, pp. 664-666, 4 figs. Rotary blowers and fans classified and described. Limitations, characteristics in operation and power requirements. Motors best adapted to different types and regulation to use for speed adjustment.

FATIGUE

Iron and Steel Works. Fatigue and Efficiency in Iron and Steel Works—VI, H. M. Vernon. Eng. & Indus. Management, vol. 5, no. 16, April 21, 1921, pp. 461-462. Investigations carried out by British Indus. Fatigue Research Board.

FLOW OF GASES

Pipes. Flow of Gas Calculation Chart, E. T. Anderson. Gas Age, vol. 47, no. 8, April 25, 1921, p. 322, 1 fig. Chart for calculating flow of gas in pipe.

FORGING

Drop Hammers. Air vs. Steam for Forge Shop Hammers, Chas. R. Edwards. Forging & Heat Treating, vol. 7, no. 4, April 1921, pp. 220-221 and 229, 4 figs. Compressed air gives better expansion,-no hot water drip no delay in starting. Compressed air fittings must be tighter because of lower temperature.

Cost of Operating Hammers With Air or Steam, G. H. Richey. Forging & Heat Treating, vol. 7, no. 4, April 1921, pp. 217-218. Calculations for ascertaining cost of operating hammers with compressed air and steam. Advantages of operating with air.

FORGING PLANTS

Layout. Shop Well Planned for Material Handling, Gilbert L. Lacher. Iron Age, vol. 107, no. 18, May 5, 1921, pp. 1159-1162, 5 figs. Layout of plant of Kropp Forge Co., Cicero, Ill.

FORMING TOOLS

Straight. Dimensions of Straight Forming Tools, Machy. (Lond.), vol. 18, no. 448, April 28, 1921, pp. 103-107, 1 fig. Tables giving depth of steps on straight forming tools measured at right angles to front face, corresponding to various differences between radii on work.

FOUNDRIES

Design. Foundry Design Needs Study, J. H. Hopp. Foundry, vol. 49, no. 9, May 1, 1921, pp. 345-347. Foundry buildings should be designed with view of co-ordinating structure with demands of operation and protecting equipment against elements. Paper read before Am. Foundry'men's Assn.

Metal. Utilization of Scrap and Residues in Metal Foundries—I, C. Diegel. Metal Industry (N. Y.), vol. 19, no. 5, May 1921, pp. 196-197. German practice. Translated from Betrieb.

FURNACES, ANNEALING

Electric. Electricity Applied to Annealing, George P. Mills. Foundry, vol. 49, no. 9, May 1, 1921, pp. 366-368. Pit furnaces heated electrically by means of resistance ribbon are described. Pyrometric control with either single or double-point recorder regulates temperature closely.

Rotary. Rotary Furnaces for the Economic Combustion of Coal Having Large Ash Content (Foyer rotatif pour la combustion économique des charbons très cendreux), L. Poirson. Chaleur & Industrie, vol. 2, no. 3, Mar. 1921, pp. 120-124. 6 figs. Grating is formed by inclined cylinder which is continuously rotating. Coal is burned inside cylinder.

FURNACES, HEATING

Sheet Bar vs. Mill Type. Heating Furnaces and Annealing Furnaces, W. Trinks. Blast Furnace & Steel Plant, vol. 9, no. 5, May 1921, pp. 305-308, 7 figs. Critical comparison of pair (sheet bar) and of mill type furnaces. Sheet bar furnaces are continous.

Sheet Furnaces. Heating Furnaces and Annealing Furances, W. Trinks. Forging & Heat Treating, vol. 7, no. 4, April 1921, pp. 222-227, 10 figs. Comparison of different types of sheet furnaces.

FURNACES, HEAT TREATING

Car vs. Car-and-Ball. Car and Car-and-Ball Furnaces. Machy. (N.Y.), vol. 27, no. 9, May 1921, pp. 873-875, 5 figs. Relative merits of heat-treating furnaces of car-and-ball types.

Screw-Thread. The Manufacture of British Association Screw-Thread Gauges, Farrance Davey. Jl. Instn. Mech. Engrs., no. 5, April 1921, pp. 191-196. Design methods and apparatus used in measurement, compensation and correction for errors in lathe, cutting tools, lupping, and heat treatment.

G

GAGING

Limit. The Principles of Limit Gauging, A. A. Remington. Engineering, vol. 111, nos. 2885 and 2886, April 15 and 22, 1921, pp. 441-443, 7 figs., and 480-482, 5 figs. Attempt to build up logical system of limit gaging from first principles. Exposition of Newall standard system, extensively used in England.

GALVANIZING

Developments. 60 Years Progress in Galvanizing, Clement F. Poppleton. Iron Trade Rev., vol. 68, no. 17, April 28, 1921, pp. 1170-1174, 4 figs. Comparison of English and American process.

GAS ENGINES

See Blowing Engines, Gas-Driven.

GAS MANUFACTURE

Low-Temperature Carbonization. Low Temperature Carbonization of Coal, Steward J. Lloyd. Am. Gas Jl., vol. 114, no. 17, April 23, 1921, pp. 253-354 and pp. 363-364. Survey of recent developments.

Elliot Gas. Elliot Gas, a Substitute for Natural Gas, F. J. Denk. Forging & Heat Treating, vol. 7, no. 4, April 1921, pp. 207-212, 5 figs. Process of manufacturing combination coal and water gas from bituminous coal.

GASES

Dust Precipitators. A New Electrical Precipitation Treater, Motoji Shibusawa and Jasujiro Niwa. Researches of Electrotechnical Laboratory, no. 82, Feb. 1921, 31 pp. 35 figs. Cottrell precipitator with glass covered electrode.

GEARS

Helical. The Sykes, Double Helical Gear Generator. Engineering, vol. 111, no. 2887, April 29, 1921, pp. 520-522, 7 figs. Cutters are retained in gearing contact with wheel being cut and rotate during process of generation. Machine manufactured by Power Plant Co., West Drayton, England.

Involute. The Evolution of the Involute Gear Tooth—IV, A. Fisher, Machy. (Lond.), vol. 18, no. 447, April 21, 1921, pp. 70-72, 1 fig. Limitations necessitated partly by requirements of interchangeability and partly by solidity of metal.

Maag. The Maag System of Gearing—II. Engr., vol. 131, no. 3407, April 15, 1921, pp. 403-404. 2 figs. Teeth of each wheel are formed on pitch circle of diminished diameter at pressure angle of 15 deg.

Thereafter teeth are pushed out radially at proportionate rates until teeth of one wheel touch teeth of other at point dividing line joining shaft centers in desired gear ratio.

Spur. Formulae for Measuring Spur Gears by the Pin Method, M. D. Wilson, Mach. (Lond.), vol. 18, no. 447, April 21, 1921, pp. 92-94,4 figs.
See also Maag.

GRAIN ELEVATORS

Floating. Floating Pneumatic Grain Discharging Plant. Engr., vol. 131, no. 3406, April 8, 1921, pp. 378 and 381-384, 9 figs. Combination of pneumatic and hand systems for simultaneously discharging from grain ship to lighters by spouts or by means of band conveyor across deck of ship to bands below quay. Capacity is 180 tons per hour. Plant is carried on reinforced-concrete pontoon.

Reinforced-Concrete. Kansas Central Elevator Storage Annex, W. F. Leggett. Eng. World, vol. 18, no. 5, May 1921, pp. 335-337, 5 figs. Erection of reinforced-concrete annex to enlarge storage capacity to 250,000 bu.

GRINDING

Fixtures. The Use of Special Fixtures in Grinding Operations, Ellsworth Sheldon. Am. Mach., vol. 54, no. 17, April 28, 1921, pp. 736-739, 10 figs. Cylindrical work ground on dead centers. Special holding devices for grinding chuck shells. Magnetic chucks provided with holding strips and aligning bars.

H

HANDLING MATERIALS

Factories. Purchasing and Handling Material in a Moderate Sized Factory—I, Guy V. Sweet. Indus. Management, vol. 41, no. 9, May 1, 1921, pp. 335-337, 5 figs. Forms for keeping records of moving material.

Foundries. Handling 168 Tons for Every Ton Produced, Max Sklovski. Material Handling Mag., vol. 2, no. 1, Mar. 1921, pp. 5-7, 1 fig. Analysis of material handling system of modern foundry.

Steel Products. Efficient Handling and Trucking of Steel Products, E. C. Phillips. Iron Age, vol. 107, no. 20, May 19, 1921, pp. 1294-1295. Devices to speed loading and unloading of motor trucks.

HARBOUR IMPROVEMENTS

Toronto. Toronto Harbour Improvements, E. L. Cousins. World Ports, vol. 9, no. 7, May 1921, pp. 59-89, 22 figs. Work being undertaken to provide adequate facilities for industrial and commercial expansion to co-ordinate rail and water traffic and to reclaim and improve lands for park and recreation purposes.

Vancouver. The Port of Vancouver and Its Proposed Development, O. H. Kirkpatrick. World Ports, vol. 9, no. 7, May 1921, pp. 101-110, 3 figs. Construction of pier with transit sheds and warehouses.

HEATING, ELECTRIC

Industrial. Industrial Electric Heating, A. E. Holloway and H. L. Carbutt. Jl. Electricity & Western Industry, vol. 46, no. 10, May 15, 1921, pp. 486-488 and 517-519, 4 figs. Report of Committee on Industrial Heating to Pacific Coast Section of National Electric Light Association.

HEATING STEAM

Central Stations. Load Dispatching in a Central Heating System, J. C. Butler. Power, vol. 53, no. 17, April 26, 1921, pp. 648-651, 7 figs. Meter board in chief engineer's office of Illinois Maintenance Co., Chicago. Flow of steam is measured and recorded.

HOUSING

Europe. Notes on the Housing Situation in Northern Europe. Monthly Labor Rev., vol. 12, no. 4, April 1921, pp. 127-133. Survey of laws passed to re ieve emergency and of measures taken to stimulate building of houses.

Industrial. Erecting Houses on Quantity Production Basis. Contract Rec., vol. 35, no. 17, April 27, 1921, pp. 407-409, 10 figs. Typical examples of industrial homes at Walkerville, Ont. Contractor's methods ensure completion of job in 150 working days.

Industrial Housing, Leslie H. Allen. Textile World, vol. 49, no. 18, April 30, 1921, pp. 119-123. Arguments for and against company housing.

HYDRAULIC TURBINES

High-Speed. High-Speed Water Turbines (Schnellaufende Wasserturbinen), Fr. Oesterlen. Zeit. des Vereines deutscher Ingenieure, vol. 65, no. 16, Apr. 16, 1921, pp. 409-414, 14 figs. Notes on development of high speed and rotor construction up to 1913; breaking tests with a very high-speed turbine by Kaplan in 1913; latest development of the Francis high-speed and Kaplan turbines up to rotor with only two rotatable blades; the new Kaplan draft-tube system; draft-tube construction and high-speed rotors in America.

HYDROELECTRIC PLANTS

Canada. Nipigon Power Development of Ontario Hydro Commission, T. C. James. Elec. News, vol. 30, no. 8, Apr. 15, 1921, pp. 30-37, 20 figs. also in Contract Rec., vol. 35, no. 16, April 20, 1921, pp. 389-395, 71 figs. Twenty-five thousand horsepower now available to be increased to three times that amount as demand develops. Transmission at 110,000 volts.

Economics. Economics of Hydro-Electric Development, A. H. Gibson. Engr., vol. 131, nos. 3406-3407, April 8 and 15, 1921, pp. 367-369, 3 figs. and 393-394. Apr. 8: Derivation of formulas from general economic considerations and records of actual cases. Apr. 15: Examination of typical Canadian, American and European installations indicates that total annual costs, excluding transmission and taking 6 per cent as rate of interest on capital, amount very nearly to 9.5 per cent of capital cost.

Efficiency. Increasing the Efficiency of Water-Power Plants, Charles M. Allen. Power, vol. 53, no. 19, May 10, 1921, pp. 761-762, 2 figs. Speed-horse-power curves for various heads. Paper read before Technical Assn. of Pulp and Paper Industry.

Operation. Operation for Maximum Output, and Operating Records, Geo. H. Bragg. Jl. of Electricity & Western Industry, vol. 46, no. 10, May 15, 1921, pp. 504-508, 5 figs. Investigation of a number of western hydroelectric systems. Report of Sub-Committee of the Hydraulic Committee to Pacific Coast Section of National Electric Light Association.

I

IMHOFF TANKS

Construction. Special Features of Imhoff Tank Construction, George B. Gascoigne. Mun. & County Eng., vol. 60, no. 4, April 1921, pp. 135-140, 6 figs. Typical installations.

INDUSTRIAL CONDITIONS

Europe. Our National Industries and International Business, Dwight T. Farnham. Indus. Management vol. 41, no. 9, May 1, 1921, pp. 331-334. Altered European industrial conditions and their effect on American employer and employee.

INDUSTRIAL MANAGEMENT

Inspection. Principles of Inspection, Louis Ruthenburg and R. A. Crist. Machy (N. Y.), vol. 27, no. 9, May 1921, pp. 859-862. Review of principles upon which rational inspection methods are based, with special application to interchangeable manufacture.

International Organization. Building an International Business Organization, George M. Gales. Indus. Management, vol. 41, no. 9, May 1, 1921, pp. 319-323. Writer's experience in organizing Liggett's International Ltd. Notes on British personnel and English business attitude toward America.

Machine Cards. Alphabetical and Mnemonic Symbols on Tabulating Machine Cards, C. Moffitt Ford. Indus. Management, vol. 41, no. 9, May 1, 1921, pp. 347-350, 2 figs. Methods for expressing alphabetical, semi-alphabetical and memonic symbols on tabulating machine cards.

Production Systems. Controlling Production. Eng. Production, vol. 2, no. 30, April 28, 1921, pp. 531-537, 4 figs. System of handling components in batches.

Routing Materials. System for Production Control. Machy. (Lond.), vol. 18, no. 450, May 12, 1921, pp. 179-181, 8 figs. Methods employed in plant of American Multigraph Co. for routing and recording progress of work.

Shop Analysis. The Zoning of Jobs, Hugh L. Clary. Indus. Management, vol. 41, no. 9, May 1, 1921, pp. 334-329, 4 figs. Suggests plans for analyzing certain classes of positions as to requirements for compensation.

INDUSTRIAL TRUCKS

Electric. Electric Trucks and Industrial Locomotives—V-VIII. Engr., vol. 131, nos. 3406-09, April 8, 15, 22 and 29, 1921, pp. 374-376, 10 figs., 402-403, 8 figs., 424-426, 8 figs., and 456-458, 8 figs. Typical British designs.

INSULATING MATERIALS

Research. Industrial Research Work on Insulating Materials. Engineering, vol. 111, no. 2886, April 22, 1921, pp. 482-484, 6 figs. Accounts of work undertaken by Research Committee of Vickers, Ltd., England.

INTERNAL-COMBUSTION ENGINES

Induction Pipes. Induction and Exhaust Pipes. Automobile Engr., vol. 11, no. 149, April 1921, pp. 150-152, 18 figs. Résumé of some recert experiments in Germany.

See also Aeroplane Engines; Automobile Engines; Diesel Engines; Gas Engines; Gasoline Engines; Indicators; Oil Engines.

IRRIGATION

Flumes. Good Practice and Some Features in Log-Flume Construction, F. K. Woods. Eng. News-Rec., vol. 86, no. 18, May 5, 1921, pp. 768-770, 5 figs. Description of 5-ft. side flume in northern Idaho.

Interstate Water Conflicts. Interstate Water Conflicts and Possible Solution. Eng. News-Rec., vol. 86, no. 18, May 5, 1921, pp. 755-759. Symposium of papers by representative American engineers.

Western Canada. Large Irrigation Projects in Western Canada, E. F. Drake. Contract Rec., vol. 35, no. 17, April 27, 1921, pp. 419. 990,000 acres of irrigable land are involved in developments which will proceed soon. Reclamation service to make surveys this year on another 1,100,000 acres.

J

JIGS

Design. Tool Engineering, Albert A. Dowd and Frank W. Curtis. Am. Mach., vol. 54, nos. 17, 18 and 19, April 28, May 5 and 12, 1921, pp. 720-725, 12 figs. 770-772, 9 figs. and 816-819, 14 figs. Effect of design on manufacture. Consideration of limits of accuracy. Selection of working points. Relation of design to cost of machining. Drill-jig design. Location of rough and finished work. Correct and incorrect location and clamping. Types of jigs.

L

LABOUR

Railroad Labour Board. Principles to Govern Agreements Defined by Labour Board. Ry. Mech. Engr., vol. 95, no. 5, May 1921, pp. 287-289. Text of board's decision on national agreements.

LABOUR TURNOVER

Records. The analysis of Labour Records, David R. Craig. Indus. Management, vol. 41, no. 9, May 1, 1921, pp. 374-376, 1 fig. Chart for vizualizing variables entering into labour turnover.

LIFTING MAGNETS

Types. Electric Lifting Magnets. Eng. Production, vol. 2, no. 28, April 14, 1921, pp. 472-474, 3 figs. Typical designs. Paper read before Staffordshire Iron & Steel Inst.

LIGTING

Industrial. The Safety Features of Industrial Lighting, Samuel G. Hibben. Trans. Illuminating Eng. Soc., vol. 16, no. 3, April 30, 1921, pp. 47-55, 12 figs. Relation between light speed and safety in industrial operations.

LOCOMOTIVE BOILERS

Tubes. Notes on Fractures in Locomitove Boiler Tubes, Henry Fowler. Engineering, vol. 121, no. 2885, April 15, 1921, pp. 466-467, 11 figs. Analyses of superheater flue tubes taken out of engine of Midland Ry. locomotive which had run 60,000 miles. Photomicrographs. Paper read before Faraday Soc.

LOCOMOTIVES

Automatic Control of Cut-Off. Automatic Operation of Reverse Lever Accomplished, E. S. Pearce. Ry. Rev. vol. 68, no. 21, May 21, 1921, pp. 763-770, 13 figs. Apparatus consists of two differential valves set one lb. apart, one shortening cut-off when back pressure increases and the other lengthening cut-off when back pressure decreases.

British. British Locomotives in 1920, J. F. Gairns. Bul. Int. Ry. Assn., vol. 3, no. 4, April 1921, pp. 409-418, 6 figs. Characteristics of leading designs.

Connecting Rods. Machining Operations on Locomotive Connecting Rods, Frank A. Stanley. Am. Mach., vol. 54, no. 19, May 12, 1921, pp. 811-813, 12 figs. Practice in shops of Southern Pacific Co. at Sacramento, Cal.

Continuous Draft. Continuous Draft in Locomotives (Le tirage continu dans les locomotives), H. Daubois. Arts et Métiers, no. 3, Dec. 1920, pp. 55-57, 2 figs. Disadvantage sof pulsating draft produced by exhaust steam locomotives. Device for rendering draft continuous.

Design. Some Features of the Design of Locomotives Introduced for the Purpose of Modifying Their Effect on the Track, Frank Williams. Jl. Eng. Inst of Canada, vol. 4, no. 5, May 1921, pp. 309-311, 4 figs. Effect of static load, dynamic augment, impact, lateral flange thrust and abrasion on locomotive design.

The Design of Large Locomotives, M. H. Haig. Mech. Eng., vol. 43, no. 5, May 1921, pp. 311-314, and 326, 6 figs. Features which keep engine in service maximum length of time, reduce maintenance and repair costs, and increase revenue-earning power.

Injectors. The Advantages of the Exhaust Steam Injector, Clarence Roberts. Ry. Mech. Engr., vol. 95, no. 5, May 1921, pp. 290-291, 3 figs. Experience of French and English railways in use of exhaust-steam injector.

Production Methods. Automatic Production Methods in a Locomotive Works. Eng. Production, vol. 2, no. 30, April 28, 1921, pp. 545-550, 15 figs. Methods and tools employed at works at Lancashire & Yorkshire Ry. Co., England.

Superheater. Modern Express Locomotives, M. Igel. Eng. Progress, vol. 2, no. 3, Mar. 1921, pp. 49-54, 10 figs. German superheating locomotives.

Valve Gears. Railway Machine Shop Practice—II, Edward K. Hammond. Machy. (N. Y.), vol. 27, no. 9, May 1921, pp. 855-858, 8 figs. Methods of machining parts of locomotive valve gears, valves and pistons.

Engineering Index

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Section M-Z July Engineering Index. August Index follows.

M

MACHINE SHOPS

Layout. A Modern Tractor Building Machine Shop, J. V. Hunter. Am. Mach., vol. 54, no. 19, May 12, 1921, pp. 804-807. General layout of tools and equipment. Arrangements on cranes and conveyors. Heating and lighting systems.

MACHINERY

Depreciation. A Method for the Depreciation of Machinery, H. C. Marris. Eng. & Indus. Management, vol. 5, no. 15, April 14, 1921, p. 426, 1 fig. Method of determining depreciation of machinery. Graph illustrating differences between method of depreciation on logarithmic basis and method of equal annual fractions.

Noise Examination. The Examination of Noise in Mechanisms. Automobile Engr., vol. 11, no. 149, April 1921, pp. 148-149, 6 figs. Dual valve tectoscope for detecting a locating sound.

Vibrations. Eliminating Vibration, an Enemy of Production, Charles L. Hubbard. Factory, vol. 26, no. 9, May 1, 1921, pp. 1075-1078, 10 figs. Methods of insulating against foundation vibration.

MACHINING METHODS

Swiveling slide. Machining a Swiveling Slide. Eng. Production, vol. 2, no. 28, April 14, 1921, pp. 490-491, 5 figs. Notes on methods and tools employed.

MALLEABLE IRON

Melting. American Malleable Cast Iron—X. H. A. Schwartz. Iron Trade Rev., vol. 68, no. 19, May 12, 1921, pp. 1317-1321, 8 figs. Melting processes.

Foundries. American Malleable Cast Iron—IX, H. A. Schwartz. Iron Trade Rev., vol. 68, no. 17, April 28, 1921, pp. 1175-1180, 7 figs. Notes on organization, layout, labor and equipment of malleable foundry.

METALS

Failure. The Mechanism of Failure of Metals from Internal Stress, W. H. Hatfield. Engineering, vol. 111, o. 2884, April 8, 1921, p. 435. Experiments on wrought iron, brass and silver. It is concluded that except in certain cases where selective chemical or physico-chemical action causes separation of remains of crystals from each other, fractures are generally due to internal stresses introduced during processes of manufacture. (Abstract.) Paper read before Faraday Soc.

Fatigue. Metal Fatigue Under Repeated Stresses. Jl Soc Automotive Engrs., vol. 8, no. 5, May 1921, pp. 417-418. Survey of tests by various experimenters. Paper read before Am Iron & Steel Inst

Microstructure. Internal Stresses in Relation to Micro-Structure, J C W Humfrey. Engineering vol. 111, no. 2884, April 8, 1921 pp 419-120, 2 figs Study of microstructure of metals and of mechanism of their behavor under plastic deformation. It is suggested that elastic limit be determined by alternating tests rather than by tensile tests. (Abstract.) Paper read before Faraday Soc.

METRIC SYSTEM

Arguments Against Adoption in U.S. Why the Metric System Should Not Be Adopted, W. R. Ingalls. Min. & Metallurgy, no. 173, May 1921, pp 15-16. Reasons against compulsory adoption of metric system in U. S.

Arguments in Favor of Adoption in U. S. Why it Should Be Done the Metric Way, Howard Richards, Jr. Min. & Metallurgy, no. 173, May 1921, pp. 13-11. Advantages of system. Reasons why it should be adopted in U. S.

MILLING

Fixtures. Milling Square-Stem Pinions, Machy. (N. Y.), vol. 27, no. 9, May 1921, pp. 849-851, 4 figs. Fixtures designed by Brown-Lipe-Chapin Co., Syracuse, N. Y.

Production Systems. Interesting Milling Operations. Eng. Production, vol. 2, no. 28, April 14, 1921, pp. 475-480, 15 figs. Production systems at works of Alfred Herbert, England.

MILLING CUTTERS

Face and Form Mills. Metal Cutting Tools,—IX, A. L. DeLeeuw. Am. Mach., vol 54, nos. 17 and 19, April 28 and May 12, 1921, pp. 732-735, 5 figs. and 807-810, 13 figs. April 28. Types of face-mills. May 12: Principle of construction of form mill.

MILLING MACHINES

Horizontal. Horizontal Milling Machine. Engineering, vol. 111, no. 2886, April 22, 1921, pp. 481-486 5 figs. Heavy constant speed drive horizontal milling machines built by Brown & Sharpe Mfg. Co., Providence, R.I.

MINING

Prospecting. Prospecting, Past and Future, T. A. Rickard. Min. & Sci. Press, vol. 122, no. 17, April 23, 1921, pp. 559-566. Address delivered before Int. Min. convention.

MORTARS

Cement-Sand-Lime. Strength of Cement-Sand-Lime Mortars, H. H. Scofield. Cornell Civil Engr., vol. 29, no. 7, April 1921, pp. 125-126 and VIII, 3 figs. Tabulated results of tests.

MOTOR TRUCKS

Trailers. The Tracking and Steering of Trailers Analysed by a Graphic Method, Marins C. Krarup. Automotive Industries, vol. 44, nos. 18 and 19, May 5 and 12, 1921, pp. 955-957, 7 figs., and 1008-1011, 4 figs Engineering investigation of factors bearing upon steering and tracking of various trailer outfits. Free trailing more suitable for short hauling outfits; and steady steering for slow hauling. Graphic method of analysis.

MOTORCYCLES

Performance. Comparative Motorcycle Performance, D.S. Heather. Automobile Eng., vol. 11, no. 150, May 1921, pp. 187-194, 22 figs. Tests for determining effect of road service irregularities of mud, and also to study deceleration resulting from wind resistance.

N

NATURAL GAS

U. S. Industry. Economic Aspects of Natural Gas, E. G. Sievers. Gas Age, vol. 47, no. 9, May 10, 1921, pp. 355-359, 3 figs. Review of conditions in natural gas industry of U. S.

OIL ENGINES

Fuel Injection. Air-Injection or Mechanical-Injection—IV, J. L. Chaloner. Motorship, vol. 6, no. 5 May 1921, p.399. Comparison from exhaust temperatures record of relative degree of combustion for two systems. (Concluded.)

OIL FIELDS

Mackenzie River Valley. Suggestions to Oil Prospectors in the Mackenzie River Valley, E. M. Kindle. Can. Min. Jl., vol. 42, no. 18, May 6, 1921, pp. 356-361, 10 figs.

Northwestern Canada. The search for Oil in the West. Can. Min. Jl., 42, no. 16, April 22, 1921, pp. 313-323, 20 figs. Account of prospecting operations Notes on geology of region. Paper read before Can. Inst. Min. & Metallurgy.

South America. The Oil Resources of South America, Henry B. Milner. Min. Mag., vol.24, no. 4, April 1921, pp. 203-210, 1 fig. Republics of Argentine, Ecuador, Columbia and Venezuala are believed to offer substantial opportunities for profitable investigations because they include areas in which both geological and structural conditions are suitable to oil accumulation.

Underground Conditions. Underground conditions in Oil Fields, A. W. Ambrose. U. S. Dept. of Interior, Bur. of Mines, bulletin 195, 1921, 248 pp. 43 figs. Points out general method of procedure in studying underground conditions in oil fields, and urges co-operation between technical and practical men in application of engineering methods in developments of oil field.

Specifications. New Fuel Oil Specifications. Oil News, vol. 9, no. 8, April 20, 1921, p. 28. Specifications for various grades used by U. S. Government.

OIL SHALES

Distillation. A Study of the Saturated and Unsaturated Oils from Shale, C. W. Botkin. Chem. & Metallurgical Eng., vol. 24, no . 20, May 18, 1921, pp. 876-880. Investigation of amount and causes of unsaturates in shale oils. Cracking during retorting and distillation accompanied by increase in saturat tion. Unsaturates vary with nature of shale and methods of pyrolysis.

OIL WELLS

Oil Production. Some principles Governing the Production of Oil Wells, Carl H. Beal and J. O. Lewis. U. S. Dept. of Interior, Bur. of Mines, bul. 194, 1921, 58 pp. 7 figs. Conditions affecting amount of oil in oil sand. Factors that control rate of production in oil wells. Effect of production of one well on that of another.

OPEN HEARTH FURNACES

Control Valve. New Oil Fuel Control Valve for Open Hearth Furnaces. Iron Age, vol. 107, no. 18 , May 5, 1921, p. 1163. Combination Three way and proportional discharge valve designed by S. A. Gabriel & Co., Cleveland.

Heat Transfer. Heat Transfer in Open Hearth Furnaces, Henry William Seldon. Blast Furnace & Steel Plant, vol. 9, no. 5, May 1921, pp. 299-304. Survey of experimental studies made by various investigators in different countries.

OXY-ACETYLENE WELDING

Tests. An investigation of Oxy-Acetylene Welding and cutting Blow-pipes, R. S. Johnston. Mech. Eng., vol. 43, no. 5, May 1921, pp. 305-310 and 359, 8 figs. Tests carried out by Bur. of Standards for War Department on commercial apparatus for cutting and welding by oxy-acetylene welding process.

See also *Autogenous Welding.*

P

PAPER MANUFACTURE

Laboratory Tests. An Outline of Laboratory Tests Used in Pulp and Paper Making, A. Le Chatelier. Paper, vol. 28, no. 8, April 27, 1921, pp . 17-21. Translated from Chimie et Industrie.

PATTERN MAKING

Shop Organization. A Model Pattern Shop and Storage Building, Gilbert L. Lacher. Iron Age, vol. 107, no. 18, May 5 , 1921, pp. 1165-1168, 7 figs. Pattern storage of Whiting Corporation , Harvey, Ill.

PAVEMENTS

London. English Road Building Practice. Contract Rec., vol. 35, no. 19, May 11, 1921, pp. 466-470. Methods used in paving streets of London as indicated in report of Metropolitan Paving Committee.

PAVEMENTS, ASPHALT

Maintanance. Care of Asphalt Paving Equipment, Henry B . Drowne. Eng. & Contracting. vol. 55, no. 18, May 4, 1921, pp. 439-440. Recommendations prepared by Asphalt Assn.

PIPE BENDS

Design. The Design of Pipe Bends for Expansion in Pipe Lines, J. G. Stewart. Power, vol. 53, no. 19, May 10, 1921, pp. 742-743, 4 figs. Chart for computing expansion of U-bends of commercial steel pipe with nominal diameters 2 in. 12 in. inclusive.

PIPE CAST-IRON

Centrifugal Process. Cast Iron Pipe Made by the de Lavaud Process, Peter Gillespie. Can. Engr., vol. 40. no 19, May 12, 1921, pp. 454-455, 4 figs. Comparative weights of pipe made by centrifugal process and sand mold pipe.

PIPE, CONCRETE

Pressure. New Type Concrete Pressure Pipe Successful in severe Test. Concrete Products, vol. 20 no. 4, April 1921, pp. 15-20, 9 figs. Steel cylinder encased in concrete the latter being reinforced by wire mesh or bars on both sides of steel cylinder.

Tests. New Concrete Pressure Pipe Tested. Concrete, vol. 18, no. 5, May 1921, pp. 242-244, 4 figs. Pipe consisting of steel cylinder and lap horizontal joint welded on outside only, the whole being encased in concrete.

PISTONS

Aluminum. Aluminum Pistons , Frank Jardine and Ferdinand Jehle, Jl. Soc. Automotive Engrs., vol. 8, no. 5, May 1921. pp. 397-403, 9 figs. Survey of recent developments in construction of aluminum pistons, and suggestions in regard to their design.

Machining Methods. Machining Motor Pistons, C. H. Dengler. Machy. (N. Y.) vol. 27. no. 9, May, 1921, pp. 878-879, 3 figs. Successive steps and equipment employed in machining pistons for high-grade automobile.

PLANING

Production System. Production Planing in Machine Tool Plants. Machy. (N. Y.) vol. 27 no. 9, May 1921, pp. 833-837, 4 figs. Efficiency factors in production planing. Points to observe in obtaining maximum output from planers.

PORTS

Canada. Canadian Port Development East and West – Toronto, V. M. Roberts. The Contract Record, vol. 35, no. 20, May 18, 1921, pp. 492-503, 14 figs. A review of constructional activities of harbour commission, with special reference to work accomplished in past year. Ports of Toronto, Vancouver and Victoria.

POWER FACTOR

Charges for Electrical Supply. The Influence of Power Factor on Charges for Electrical Supply, G. W. Stubbings. Eng. & Indus. Management, vol. 5 no. 16, April 21 , 1921, pp. 463-465, 5 figs. Technical analysis.

Determination. How Should Power Factor Be Handled ? , Charles J. Russell. Elec. World, vol. 77, no. 20, May 14, 1921, upp..1089-1093, 3 figs. Rates should take into consideration added service rendered when reactive power is supplied. Over-motoring not sole cause. of low power factor.

PUBLIC UTILITIES

Valuations. The Influence of Commodity Price Movement Upon Public Utility Valuations, H. R. Allensworth. Jl. Western Soc. Engrs., vol. 26, no. 4,April 1921, pp. 139-170, 13 figs. Interpretation of economic principles in determination of property value of public utility enterprises.

PULVERIZED COAL

Dust Explosions. How to Protect Pulverized Coal Plants From Dust Explosions and Fires. Coal Age, vol. 19, no. 17, April 28, 1921, pp. 746-749. Vacuum system should remove dust from air in building; driers should not be heated excessively; air supply for burning coal should be kept from forcing its way into coal supply line.

See also *Boiler Firing*, Pulverized Coal; *Boilers, Water-Tube, Tests.*

PUMPING STATIONS

Air-Lift. A Modern Air Lift Pumping Plant. John Oliphant Ry. Maintenance Engr., vol. 17, no. 5, May 1921.pp.172-174, 5 figs. Installation of Philadelphia & Reading Railway at Telford, Pa. 100 gal. are pumped per min. from well 350 ft. deep, 10 in. in diameter.

PUMPS

Vacuum. Dry-Vacuum Pump Capacity Tests. Snowden B. Redfield. Mech. Eng., vol. 43, no. 5, May 1921, pp. 315-318, 4 figs. Methods employing low-pressure nozzle for air measurements. Typical volumetric-efficiency curves.

PYROMETRY

Developments. Present status of Pyrometry (L'etat actuel de la pyrometrie), H. Weiss. Journal de Physique et le Radium, vol. 2, Feb. 1921, pp. 33-52. Survey of recent developments.

Industrial Applications. Pyrometric Practice, Paul D. Foote, C. O. Fairchild and T. R. Harrison, U.S.Dept. of Commerce, Technologic Papers, Bur. of Standards, no. 170, Feb. 16, 1921, 326 pp. 185 figs. Survey of practical methods in use in industries in 1920.

R

RADIOMETALOGRAPHY

Developments. X-Rays and Their Industrial Applications. Engineering, vol. 111, no. 2884, April 8, 1921, pp. 412-415, 10 figs. Developments in radiometalographic examination of materials.

RAILS

Electric Welding. *See Electric Welding, Rails.*

Fractures. Internal Fractures in Steel Rails, Henry S. Rawdon. Engineering, vol. 121, no. 2885, April 15, 1921, pp. 470-471, 2 figs. Microscopic examinations of "transverse fissures". (Abstract). Paper read before Faraday Soc.

Standardization. New Standard Rail Sections of French Roads. Ry. Age, vol. 70, no. 19, pp. 1129. Four sections adopted are 20-kg. section for narrow-gage tracks, 30-kg. section for light traffic, standard-gage lines, 40-kg. section for light traffic, standard-gage lines and 55-kg. section for use in tunnels where action of moisture and smoke results in rapid loss of metal.

RAILWAY ELECTRIFICATION.

Economics. Economic Aspect of Railway Electrification, A. H. Armstrong., Elec. Rev., vol. 24, no. 5, May 1921, pp. 405-413, 26 figs. Electrification advocated as means for solving national transportation problem.

Switzerland. Electrification of St. Gotthard Line, Switzerland, Hans W. Schuler. Ry. Age, vol. 70, no. 19, May 13, 1921, pp. 1107-1112, 13 figs. Line extends from Lucerne to Chiasso on Italian border, distance of 180 miles. There is average grade of 2.5 per cent for 30 miles. Current at 15,000 volts is supplied to locomotives.

RAILWAY MAINTENANCE

Methods. Developing Thoroughness and Permanency. Ry. Maintenance Engr., vol. 17, no. 5, May 1921, pp. 160-164, figs. Engineering and maintenance methods of Lackawanna Railroad.

RAILWAY MOTOR CARS.

Diesel-Electric. Diesel Electric Cars (Les automotrices Diesel-électriques), Lucien Pahin. Industrie Electrique, vol. 30, no. 692, April 25, 1921, pp. 145-150, 5 figs. Motors cars used in Swedish railways.

RAILWAY OPERATION.

Cost Accounting. The earnings of Individual Passenger Trains, T. W. Mathews, Ry. Age, vol. 70, no. 16, April 22, 1921, pp. 981-983, 4 figs. Method for determining whether selected trains pay out of pocket or other costs.

Freight Trains. Effect of Train Speed on Energy Consumption, G. S. Chiles and R. G. Kelley. Ry. Age, vol. 70, no. 18, May 6, 1921, pp. 1083-1084, 2 figs. Charts showing relation between resistance and speed for various average per car.

Train Despatching. A Complete Train Despatching System. Ry. Signal Engr., vol. 14, no. 5, May 1921. pp. 184-187, 4 figs. Practice of Lancashire & Yorkshire Ry., England. All train movements are controlled fron one center office. From Modern Transport, Lond.

RAILWAY REPAIR SHOPS.

Electric Welding. Railroad Shop Notes, S. Ashton Hand. Am. Mach., vol. 54, no. 18, May 5, 1921, pp. 773-777, 19 figs. Repairs on broken cylinders by electric welding. Gage for setting half-cranks on Walschaerts valve gears.

RAILWAY SWITCHES.

Control. Outlying Switch Control Facilitates Train Movements, C.C. Anthony. RY. Age, vol. 70, no.18, May 6, 1921, pp. 1077-1079. Development of low-voltage mechanisms controlled from central point.

Interlocking. New Interlocking on the Boston Elevated, W. C. Smith. Ry. Signal Engr., vol. 14, no. 5, May 1921, pp. 173-178, 10 figs. Electropneumatic plant with A. C. control and color light signals gives speed signalling indications.

RAILWAY TIES

Steel vs Wood. Steel sleepers Compared with Wood. Indian Eng., vol. 69, no. 15, April 9, 1921, p. 203. Empirical formula for computing relative economy of using steel or wooden ties, obtained from records of service of both of these types of ties in the Baden Ry., Germany.

RAILWAY TRACK

Construction. Most Roads Favor the Use of Spirals. Ry. Maintenance Engr., vol.17, no. 5, May 1921, pp. 169-172. Practice of railways in U.S. and Canada on use of easement curves in construction of railway track.

Tie Plates. Service Stresses in Tie Plates, E. P. Gowing. Ry. Rev., vol. 68, no. 17, April 23, 1921, pp. 644-645, and 650-651, 4 figs. Graphs showing distribution of pressure. From Indian Engineering.

Weed Burners. Southern Road Develops High Power Weed Burner. Ry. Age, vol.70, no. 17, April 29, 1921, pp.1033-1034. Apparatus developed in shops of Texas & Pacific. Heat at temperature of 1400 to 1500 deg. fahr. is blown upon vegetation beneath hood 38 ft. long suspended over track, giving length of contact sufficient to destroy vegetation while burner is moving five miles per hour.

REFRIGERATING PLANTS

Operation. Refrigerating Plant Economics and Capacities, I. L. Kentish-Rankin. Power Plant Eng. vol. 25, no. 9, May 1, 1921, pp. 471-477, 8 figs. Methods for increasing economy and capacity of plant.

REFUSE DISPOSAL.

Municipal Plant. Report on Equipment and Operation of Chicago's Municipal Reduction Plant. Eng. & Contracting, vol. 55, no. 19, May 11, 1921, pp. 476-480. Report upon means of increasing efficiency and economy at city's refuse reduction plant.

RELAYS

Selection. Relay Selection for Large Power Systems, R. F. Gooding. Elec. World, vol. 77, no. 18, April 30, 1921, pp. 987-989, 6 figs. Considerations governing choice of relay layout for generators, feeders and tie lines. Generators and transformers usually protected from internal trouble by differential relays but not by overload relays.

RESEARCH.

Industrial. The Central Research Laboratory of the General Motors Company, J. Edward Schipper. Automotive Industries, vol. 44, no. 17, April 28, 1921, pp. 900-901, 1 fig. Occupies building 1000 ft. long by 270 ft. wide in Moraine City, suburb of Dayton, and is operated as independent unit of G. M. C. but in co-operation with various automobile and parts plan of company, under direction of C. F. Kettering and staff of specialists.

The Conduction of Research, F. H. Norton. Sci. Monthly, vol. 12, no. 5, May 1921, pp. 424-433. Economical advantages of industrial research. Procedure in carrying out research.

Government-Conducted. Scientific and Engineering Work of the Government Its Cost and Its Value E. B. Rosa. Eng. & Contracting, vol. 55, no. 20, May 18, 1921, pp. 487-490. Activities of scientific and engineering branches of national Government, with figures relating to economic value of such work. Paper read before Washington Section, The American Society of Mechanical Engineers.

ROAD CONSTRUCTION.

Economics. Justifiable First Cost of Highways, J. E. Pennybacker. Can. Engr., vol. 40, no. 16, April 21, 1921, pp. 400-402, 3 figs. Also in Eng. News-Rec., vol.86, no. 18, May 15, 1921, pp. 770-772, 3 figs. Graphs for determination of justifiable outlay for proposed highway improvement.

Research in. Government Research in Road Construction—II, P. M. Heldt. Automotive Industries, vol. 44, no. 17, April 28, 1921, pp. 902-906 and 921, 9 figs. Investigation being conducted by U.S. Bur. of Public Roads of factors entering into strength and durability of different types of roads.

ROADS.

Bituminous Foundations. Bituminous Foundations for Highway Pavements, Hugh W. Skidmore, Eng. World, vol. 18, no. 5, May 1921, pp. 347-349. History of bituminous concrete with comments on recommended practice. Paper read before Ill. Soc. Engrs.

Impact tests. The Motor Truck Impact Tests of the Bureau of Public Roads, Earl B. Smith. Public Roads, vol. 3, no. 35, Mar. 1921, pp. It has been found in part that impact depends largely upon kind and condition of tire; thin or worn solid rubber tires produce very high impact forces, and with their use impact increases only very slightly with speed of truck; impact increases with speed of truck but it cannot be said to increase according to any constant ratio or power of speed.

ROADS, CONCRETE.

Developments. Recent Developments in Cement Concrete Roads, H. S. VanScoyoc. The Can. Engr., vol.40, no. 20, May 19, 1921, pp. 487-488. Tendency is to build wider roads with longitudinal center joint. Amount of reinforcing steel has been increase. Paper read before Can. Good Roads Assoc.

Reinforced type. Recommended Practice for Concrete Road Construction, B. H. Wait. Can. Engr., vol. 40, no. 18, May 5, 1921, pp. 433-437, 6 figs. Paper read at Highway Eng. Conference, held Feb. 7-11, 1921, under auspices of Civil Eng. Dept. of University of Pennsylvania.

ROADS, MACADAM.

Resurfacing. Resurfacing and Surface Treating Macadam Roads, T. J. Wasser. Eng. & Contracting, vol. 55, no. 18, May 4, 1921, pp. 448-451. Specifications for converting old macadam into foundation for bituminous.

ROLLING MILLS.

Electrically driven. Some Methods of Obtaining Adjustable Speed with Electrically Driven Rolling Mills, K. A. Pauly, Gen. Elec. Rev., vol. 24, no. 5, May 1921, pp. 422-432, 15 figs. Discussion of Merits of Scherbius system of speed control, both single range and double range in which slip energy of main motor is returned to system as electric energy. Comparison is made with Kraemer or synchronous converter system in which slip energy is returned to main motor shaft.

Roll Design. Foreign Methods of Roll Design, H. R. Ronnebeck. Iron & Coal Trades Rev., vol. 102, no. 2771, April 8, 1921, pp. 490-492, 18 figs. Comparison of German and American practices. Paper read before Cleveland Inst. Engrs.

S

SCREW THREADS.

Method of Producing. Various Methods of Producing Threads, J. H. Moore, Can. Machy., vol. 25, no. 17, April 28, 1921, pp. 25-31, 23 figs. Threading locomotive set screws. Steel axles. Special nuts. Tractor axles; worms; lead screws; fine pitch threads and internal threads.

SCREWS.

Gaging. Gauging and Fine Measurements—I, A. C. Wickmnn. Machy. (Lond.) vol. 18, no. 446, April 14, 1921, pp.52-55, 8 figs. Applications to production of screws.

SEWAGE DISPOSAL.

Activated Sludge. The Activated Sludge System and the "Nitrogen Question", Gilbert J. Fowler. Contract Rec., vol. 35, no. 18, May 4, 1921, pp. 443-445. Possibility of recovering greater proportion of value of nitrogen in sewage for benefit of agriculture. Review of practical experience and scientific investigation.

SHIPBUILDING.

Economics. The Design and Construction of Merchant Ships, Maxwell Ballard Shipbuilder, vol. 24, no. 129, May 1921, pp. 293-298, 5 figs. Relation between shipbuilding production, prices, and freight market. Paper read before North-East Coast Instn. Engrs. & Shipbuilders.

SHIPS.

Stability. Stability of Ships, G. R. Edgar. Shipbuilder, vol. 24, no. 129, May 1921, pp. 319-321, 2 figs. Effect of waves on transverse stability. Paper read before Instn. Engrs. & Shipbuilders in Scotland.

SIDEWALKS.

Concrete. One Course Monolithic Concrete Sidewalks Versus Two Course, F. S. Besson. Eng. & Contracting, vol. 55, no. 18, May 4, 1921, pp. 445-448, 6 figs. Examination of 1,750,000 sq.ft.concrete sidewalk in Washington led to conclusion that two-course walk is faulty in that it prevents monolithic slab action of concrete.

SLAG.

Utilization and Agriculture. Basic Slags: Their Production and Utilization in Agriculture. Trans. Faraday Soc., vol. 16, no. 2, Dec. 1920, pp. 261-335. Symposium. Papers presented were: The Utilization of Basic Slag; The Physical Chemistry of Basic Slags; The National Aspects of the Case for Increasing Supplies of Basic Slag; The Demand for Basic Slag; Basic Slag and Its Place in the Development of Agriculture; A Comparison of the Effect of Various Types of Open Hearth Basic Slags on Grassland; Solubility of Basic Slag; The Improvement of Low Grade Basic Slag; Formation of Basic Slag in the Manufacture of Steel.

SLIDE RULES

Navigators. Slide Rules for Navigators, Armistead Rust. U.S. Naval Inst. Proc. vol. 47, no. 218, April 1921, pp. 497-518, 6 figs. Slide rule for solving problems of astronomical investigations including time sight and "Marcq Saint-Hilaire Method".

SPRINGS.

Design. Formulas for spring Design, Edward Jacobi. Machy. (N.Y.),vol.27, no. 9, May 1921, pp. 882-884, 4 figs. Empirical formulas tried out in designing plants of Milwaukee manufacturers.

Helical. Design of Helical Springs, Joseph Kave Wood. Am. Mach., vol.54, no. 18, May 5, 1921, pp. 780-784, 3 figs. Importance of and factors entering into "material index". Determination of torsional modulus of elasticity. Control of unit fiber stress.

Leaf. Design and Heat Treatment of Leaf Springs, H. E. Hemstreet. Forging & Heat Treating, vol. 7, no. 4, April 1921, pp.240-242. Times and temperature for hardening and drawing.

Testing. Magnetic Spring Testing: T. Spooner and I. F. Kinnard. Am. Soc. for Testing Matls., advance paper, 8 pp. 3 figs. Apparatus used and results obtained in magnetic tests on helical steel springs. Hysteresis method of testing is believed to furnish ready commercial method of checking quality and heat treatment of finished springs.

Spring Testing. Automobile Engr., vol. 11, no. 149, April 1921, pp.142-144, 5 figs. Amsler universal machine for testing springs under pressure of from 2 to 100 tons.

STAMPING.

Typical Operations. The Economics of Drawing and Forming Metals, Robert Holmes. Raw Material, vol. 4, no. 4, April 1921, pp. 124-128, 13 figs. Typical stamping operations. Records of costs.

STANDARDIZATION.

Economics. Standardization of Products, Melvin T. Copeland. Bul. Taylor Soc., vol. 6, no. 2, April 1921, pp. 55-64 and (discussion) pp. 64-76. Economical advantages of standardization.

Fillets for Revolving Parts. Standard Fillets for Revolving Parts (Normale Abrundungen an Drehteilen), K. Schenck. Der praktische Maschinen-Konstrukteur, vol. 53, no. 51, Dec. 23, 1920, pp. 436-438, 3 figs. Suggestions for carrying out a standardization system for filletting shoulders of shafts and rounding off the corresponding portion of brasses or bearings in which they revolve.

Machinery. Report of the German Industry Committee on Standards (Mitteilungen des Normenausschusses der Deutschen Industrie). Betrieb, vol. 3, no. 15, April 25, 1921, pp. 207-219, 16 figs. Proposals of Board of Directors for plug gages, limit gages, holders, measuring disks, and holders, and end gages. Proposed new standards for circular dies, die caps and holders.

STEAM TURBINES.

Developments. Some Recent Developments in Large Steam Turbine Practice, K. Baumann. Eng., vol. 111, nos. 2884, 2885, 2886, 2887, 2888 and 2889, April 8, 15, 22, 29, May 6 and 13, 11921, pp.435-439, 449-453, 501-504, 532-535, 567-571 and 597-600, 38 figs. April 8: Outline of turbine practice from 1912 to 1921 based on published records and other information, indicating circumstances which have resulted in "race for maximum output at highest possible speed." speed. April 15: Factors affecting development of large turbines. April 22: Basis of calculations for improvement in heat consumption possible with improved steam conditions. April29: Economical rating of given turbine frame. May 6: comparison of different types of turbo machines. May 13: Tests on steam consumption of large turbines. Paper read before Instn. Elec. Engrs.

Lubrication. Keeping Steam Turbine Lubricating Oil in Good Condition,Charles H. Bromley. Gen. Elec. Rev., vol. 24, no. 5, May 1921, pp. 414-421, 7 figs. Various processes employed including batch system, continuous filtration, and continuous by-pass are described, and list of requirements of efficient oil filtration system is given.

STEEL.

Alloy. see *Alloy Steels.*

Automobile. Further Notes on Automobile Steels, W. H. Hatfield. Automobile Engr., vol. 11, no.149, April 1921, pp.153-158, 4 figs. Experiments at Brown-Firth Research Laboratories to establish actual fatigue range of different steels.

Carbon Determination. Electrolitic Resistance Method for Determining Carbon in Steel, J. R. Cain, L. C. Maxwell. U.S. Dept. of Commerce, Technologic Papers, Bureau of Standards, no. 141, Dec. 6, 1919, 21 pp. 6 figs. Method for determining carbon dioxide by absorbing it in barium hydroxide solution and measuring resistance change of solution in relation to its concentration. Suitable absorption vessel with electrolytic resistance cell incorporated.

Intercrystalline Fracture. Inter-Crystalline Cracking of Mild Steel in Salt Solutions, J. A. Jones. Engineering, vol. 121, no. 2885, April 15, 1921, pp. 469-470, 7 figs. Photomicrographic and chemical analyses. It is believed one of determining factors in production of cracks is presence of internal or applied tensile stress, and fracture occurs only when these stresses are above certain value. Condition of slightly elevated temperature alone was not found to be responsible for producing cracks in internally-stressed steel. (Abstract). Paper read before Faraday Soc.

Tests. Impact Tests on Cast Steel, F. C. Langenberge Am. Soc. for Testing Matls., advance paper, 11 pp. 4 figs. Tests made to determine effect of phosphorus upon physical properties of cast steel, also effect of heat treatment upon acid open-hearth cast steel.

Tool. Action of Internal Stress on Tool Steel, J. Neil Greenwood. Engineering. vol. 111, no. 2887, April 29, 1921, pp. 535-537, 1 fig. Origin of internal stresses in pure metals and alloys are grouped in two main classes; those due to distortion by cold working and those resulting from suppression of phase changes by rapid cooling. Conditions governing hardening of steel are set out in detail and volume changes causing internal stresses are analysed. Phenomena of spontaneous change are examined in light of results published by Matsushita. Paper read at joint meeting of Faraday Soc. with other institutions.

STEEL MILLS

Handling Materials. Mechanical Handling of Steel Mill Material, C. F. Poppleton Blast Furnaces & Steel Plant, vol. 9 no. 5, May 1921, pp. 291-298, 12 figs. Methods at Midland plant of Pittsburgh Crucible Steel Co.

STOKERS

Underfeed. Development and Application of Underfeed Stoker, Edward Rahm, Jr. Proc. Engrs. Soc. of Western Pa. vol. 37, no. 1, Feb. 1921, pp. 21-52 and (discussion) pp. 53-68, 16 figs. History of developments in U. S.

STREET RAILWAYS

Franchises. Features of the New Paris Franchise. Elec. Ry. Jl., vol. 57, no. 19, May 7, 1921, pp. 847-849. Earlier agreements, similar to American service-at-cost franchises, failed to stand war strain. New deal involves consolidation of properties, 4.9 per cent net return to investor guaranteed by state and rewards to management and men based on increasing traffic and achieving economies.

STREETS

Intersecting Grade Curves. Computing Parabolic Curves for Street Grades, Walter W. Kane. Public Works, vol. 50, no. 18, April 30, 1921, pp. 373-374, 2 figs. Methods of solving problems arising in computing curves for connecting different grades at their intersections.

STRESSES

Photoelastic Analysis. Photo-Elasticity for Engineers—V, E. G. Coker. Gen. Elec. Rev., vol. 24, no. 5, May 1921, pp. 455-466, 14 figs.. Stress-strain properties of nitro-cellulose and law of its optical behavior

SUBSTATIONS

Automatic. The Automatic Substation in Electrolysis Mitigation, E. R. Shepard. Elec. Ry. Jl., vol. 57, no. 18, April 30, 1921, pp. 805-808, 11 figs. Investigation at Des Moines, Iowa, by Bur. of Standards confirmed theoretical conclusion that increase in number of feeding points made possible by automatic control acts to reduce track gradients and potentials.

SUPERHEATERS

Design. Modern Practice with Steam Superheaters and Their Fields of Use, H. B. Oatley. Jl. Eng. Inst. of Canada, vol. 4, no. 5 May 1921, pp. 289-300 17 figs. Notes on design of superheaters, including detailed study of types of installations, application and use, also comparative tables of performances with saturated and superheated steam.

Flue Tubes. The Manufacture of Flue Tube Superheaters. Engr., vlol. 131, no. 3408, April 22, 1921, pp. 438-440, 10 figs. Procedure at works of Marine and Locomotive Superheaters, Westminster, England.

T

TANKS

Design. Stresses in Flat Plates. Can. Engr., vol. 40, no. 18, May 5, 1921, pp. 443-444, 1 fig. Diagram for determining thickness of flat plates for tank bottoms.

TERMINALS, LOCOMOTIVE

Mallet Locomotives. Improving Terminals for Mallet Operation. Ry. Age, vol. 70, no. 18, May 6, 1921, pp. 1063-1068, 11 figs. Locomotive terminal of Norfolk & Western Railroad at Roanoke, Va.

Operation. Intensive Operation of Locomotive Terminals, L. G. Plant. Ry. Rev., vol. 68, no. 17, April 23, 1921, pp. 641-644, 2 figs. Urges standardization of terminal equipment and statistical control of terminal operation.

TERMINALS MARINE

Mechanical Equipment. The Handling of Goods at the Port of Manchester Warehouses. Engineering, vol. 111, nos. 2888 and 2889, May 6, and 13, 1921, pp. 541-544, 23 figs., and 576-577., 12 figs., partly on suppl. plate. There are 44 distinct warehouses which can accommodate about 500,000 tons of perishable goods under cover besides unlimited quantity in open storage. Methods of handling wool, materials in bags, cotton, etc., are described. Cold stores with capacity of 1,000,000 cu. ft.

TERMINALS, RAILWAY

New York. An Automatic Terminal Railway for New York. Eng. & Contracting vol. 55, no. 20, May 18, 1921, pp. 491-495. Plan of steam and electric yard in New Jersey for joint use of New Jersey railroads and automatic-electric system. Scheme developed by New York, New Jersey Port and Harbour Development Commission.

TESTING MACHINES

Bradley-Richards. A New Metal Testing Machine. Eng. Production, vol. 2, no. 29, April 1921, pp. 512, 2 figs. Bradley-Richards hydraulic testing machine.

TESTS AND TESTING

Brinell Hardness Testing. Ball Testing of Materials for Hardness. Brinnell Test (Etude sur l'essai de dureté à la bille. Essai Brinnell, R. Guillery. Revue de Métallurgie, vol. 18, no. 2 Feb. 1921, pp.1 - 110, 12 figs. Researches on elimination of time influence. Testing for Hardness with ball receiving pressure by impact.

Impact. Tests Under Repeated Impact (Quelques Essais aux chocs répétés), Léon Guillet. Revue de Métallurgie, vol. 18, no. 2 Feb. 1921, pp. 96-100. It was established that rupture produced by repeated impact takes place by progressive fissuration.

TEXTILE MACHINERY

Machine Running Recorder. Machine Running Recorder, Engineering, vol.111, no. 2889, May 13, 1921, pp. 580-582, 9 figs. Machines constructed for controlling operation of textile machines. Each machine is connected with instrument in such a way that an electric circuit is completed when machine stops and blank line is started on record sheet.

TEXTILES

Microscopy. The Microscopy of Textiles, F. J. Hoxie. Textile World, vol. 59, no 16. April 16. 1921, pp. 59 and 61, 3 figs. Recommands co-operative study for needed development. Paper read before Textile Division, Am. Soc. Mech. Engrs.

Winding. The Art of Winding, George W. Foster. Textile World, vol. 59, no. 16, April 16, 1921, pp.51 and 61. Its relation to production, cost and quality in textile industry. Paper read before Textile Division, Am. Soc. Mech. Engrs.

TILE

Specifications. Report of Committee C-10 on Hollow Building Tile. Am. Soc. for Testing Matls. advance paper, 10pp. Proposed tentative specifications for clay hollow building tile.

TIRES, RUBBER

Pneumatic. Design and manufacture of Pneumatic motor Tires, Colin Macbeth. Practical Engr., vol. 63, no. 1781, April 14, 1921, pp.228-232, 12 figs. Outline of manufacturing systems. Paper read before Instn. Automobile Engrs.

Truck, Pneumatic. Use of Pneumatics Limited on Trucks of More Than 3½ Ton Capacity. Automotive Industries, vol. 44, no. 18, May 5, 1921, pp. 960-961. Opinions expressed by truck and tire builders in reply to questionnaire.

TRACTORS

Tests. Data on Illinois Tractors. Jl. Soc. Automotive Engrs., vol 8, no. 5, May 1921, pp. 487-488. Survey made by Division of Farm Mechanics, University of Illinois comprising records kept by farmers on 68 tractors.

Nebraska Tractor Tests, Oscar W. Sjogren. Jl. Soc. Automotive Engrs., Vol. 8, no. 5, May 1921, pp. 391-395 6 figs. Nebraska tractor law provides that stock tractor of each model and type sold in State shall be tested and passed upon by board of three engineers under State University management.

TRANSFORMERS

Testing. Testing for Phase Rotation in Three- Phase Circuits, F. A. Kartak. Elec. World, vol. 77, no. 17, April 23, 1921, pp. 928- 929, 6 figs. Classification of methods of testing instrument transformers for phase rotation.

TUBES

Seamless. Finishing Process for Seamless Tubes. Iron Age, vol. 107, no. 17, April 28, 1921, pp. 1114-1118, 11 figs. Details of Pilgrim-Step finishing process. Working hollow ingot on mandrel, between rolls, in such manner that at each revolution of rolls small portion of ingot is rolled to tube, is principle. Translated from Stahl und Eisen.

On the Manufacture of Seamless Tubes—III Karl Gruber. Blast Furnace & Steel Plant, vol. 9 no. 5, May 1921, pp. 320-323, 9 figs. Processes of rolling seamless tube in Germany with special consideration of Mannesmann oblique rolling process. Translated from Stahl and Eisen.

TUNNELS

Vehicular. Air temperatures in the New York-New Jersey Vehicular Tunnels, Harry L. Van Zile. The Military Engineer, vol. 13, no. 68. March-April 1921, pp. 106-107. It is computed that with system of ventilation proposed temperatures of air will be raised 37° by its circulation through the tunnel.

Vehicular. Shield vs. Trench Method for Hudson Vehicle Tupes, C. M. Holland. Eng. News-Rec., vol. 86, no. 18, May 5, 1921, pp.764-766. Why shield method has been selected in preference to trench method for construction of Hudson River vehicular tunnels between New York and New Jersey.

V

VALUATION

Railways. An Analysis of the Current Valuation Report on the Kansas City Southern Properties, Samuel W. Moore. Eng. News-Rec., vol. 86, no. 19, May 12, 1921, pp. 818-821. Status of investigation of date. Present announcement of Interstate Commerce Commission includes single sums as "value" but no statement of method. Land acquisition costs apparently disallowed.

VENTILATION

Office Building. Ventilation of the Home Office Building of the Travelers Insurance Company, Hartford Conn. Am. Architect, vol. 110, no. 2364, April 13, 1921,pp.459-462, 4 figs. System is composed of two parts, (1) blower section which includes distributing apparatus, and (2) exhaust section which consists of apparatus by means of which used or vitiated air is removed from building. In each of these sections air is propelled through metal ducts and chambers by fans operated by individual electric motors.

VOCATIONAL EDUCATION

Disabled Soldiers. Making Mining Engineers from Disabled Soldiers, W. A. Clark., Eng. & Min. JL., vol. 111, no 17, April 23, 1921,pp. 706-708, 3 figs. Project of Federal Board of Vocational Education, Washington, D. C.

The Re-Education of the Disabled, J. Manclark Hollis. JL. Royal Soc. of Arts, vol. 69, no. 3568, April 8, 1921, pp. 318-324, 5 figs. Work being carried out by Village Centers Council, England.

VOCATIONAL TRAINING

Disabled Workmen. Industrial Rehabilitation—General Administration and Case Procedure. Federal Board for Vocational Educational, Bul. no. 64, Mar. 1921, 52 pp. Rehabilitation is considered from point of view of State administrations.

Pennsylvania Bureau of Rehabilitation. Bureau of Rehabilitation Pennsylvania Department of Labor and Industry Report of Activities to January 1, 1921, Bul. Dept. of Labor & Industry, vol. 3, no. 2, Jan. 1, 1921, 30 pp.

W

WAGES

Changes in Industry. Wage Changes in Industry. Nat. Indus. Conference Board, no. 35, Mar. 1921, 52 pp. Survey of wage changes in major manufacturing industries in U. S. from Sept. 1914 to end of 1920.

WALLS

Concrete. New Methods of Concrete Wall Construction for Houses. Contract Rec., vol. 35, no. 18, May 4, 1921, pp. 440-442, 5 figs. Practice as suggested in circulars issued by London Eng., County Council.

WATER FILTRATION

Effluents. Residual Aluminum Compounds in Water Filter Effluents, Abel Wolman and Frank Hannan. Chem. & Metallurgical Eng., vol. 24, no. 17, April 27, 1921, pp. 728-735, 3 figs. Theoretical considerations indicating influence of hydrogen on concentration on solubility of aluminum hydroxide. Various conceptions of aluminum sulphate reactions with natural alkaline waters.

WATER GAS

Purification. Purification of Water Gas. Gas Age, vol. 47, no. 8, April 25, 1921, pp. 315-318, 2 figs. Laboratory tests on removal of sulphur coupomnds from carburetted water gas. Paper read before Wis. Gas Assn.

WATER POWER

Argentina. Hydroelectric Power in Argentina, Leonard Matters. Sci. Am. vol. 124, no. 17, April 23, 1921, pp. 330 and 340, 2 figs. Scheme for generating 125,000 Kw. from Eguazu Falls.

Japan. Regulations Governing Development of Water Power in Japan. Elec. World, vol. 77, no. 20, May 14, 1921, pp. 1101-1104 3 figs. State governors have power to alter designs and rescind concessions. Basis of calculations required. Electric companies have right of eminent domain.

WATTMETERS

Alternating-Current. Measurement of Power at Low Power Factors, H. Cotton. The Elecn. (Lond.), vol. 86, no. 2242, May 6, 1921, pp. 544-545, 5 figs. Tables giving values of calculated correction factors.

WELDING

Steel. The Welding of Steel, H. Brearley. Engineering, vol. 111, no. 2888, May 6, 1621, pp. 551-554, 12 figs. Welding of steel in relation to occurrence of pipe, blow-holes and segregates in ingots. (Abstract). Paper read before Iron & Steel Inst.

See also Autogenous Welding; Electric Welding; Electric Welding, Arc; Oxy-Acetylene Welding; Railway Repair Shops, Electric Welding.

WELDS

Heat Treatment. Effect of Heat Treatment on Metal Arc Welds, James W. Owens J. H. Ramage and J. A. Watts. Ry. Elec. Engr., vol. 12, no. 5. May 1921, pp. 189-193, 10 figs. Metallographic studies made at U. S. Navy Yard, Norfolk, Va.

Testing. The Desirability of Standardization in the Testing of Welds, F. M. Farmer. Jl. Instn. Mech. Engrs. no. 3, April 1921, pp. 225-240 5 figs. Standards for evaluating welds are suggested and certain standards procedures are proposed for various mechanical tests.

WOOD PRESERVATION

Treatment. Modern Wood Impregnation Methods, Friedrich Moll. Eng. Progress, vol. 2, no. 3, Mar. 1921, pp. 55-56 4 figs. Ruping economic process Part of oil is forced out again.

INDUSTRIAL APPLICATIONS

Industrial Applications. X-Ray Apparutus for Workdhop Use. Engineering, vol. 111, no. 2887, April 29, 1921, p. 532, 2 figs. Portable outfit designed in research department of Woolwich Arsenal, England, for inspecting grenade boxes without opening them.

A

ACCIDENT PREVENTION.

Steel Erection. Instructions to Foreman for Prevention of Accidents in Steel Erection, Eng. & Contracting, vol. 55, no. 21, May 25, 1921, pp. 518-521. Prepared by erection department of McClintic-Marshall Co., Pittsburgh, Pa.

AEROPLANE ENGINES.

Fuels. Fuels Used in Aeroplane Engines (L'essence et les combustible semployés en aviation), M. P. Dumanois. Aérophile, vol. 29, nos. 7-8, April 1-15, 1921, pp. 110-114. Utilization of other fuels than gazoline in aeroplane engines. Tests conducted by French Aeronautical Technical Service.

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Superchargers. Aeroplane Superchargers, W. G. Noack. Aerial Age, vol. 13, nos.12, 13 and 15, May 30, and June 13 and 20, 1921, pp. 272-275, 5 figs; 322-325, 23 figs. and 347-349, 18 figs.

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AIR COMPRESSORS

Piston. The Air Losses in Piston Compressors Die Luftverluste bei Kolbenverdichtern), Arthur Balog. Fördertechnik u. Frachtverkehr, vol. 14, no. 9, Apr. 29, 1921, pp.99-100, 2 figs. Equations for approximate detremination of losses

See also Electric Drive Air Compressors.

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Design. Practical Points in the Structural Design of Aircraft, A. P. Thurston. Aeronautics, vol. 20, no. 396, May 19, 1921, pp. 355-358. Paper read before Instn. Aeronautical Engrs.

AIRSHIPS.

R. 36. Britain's First Passenger Airship. Flight, vol. 13, no. 20, May 19, 1921, pp.339-342, 7 figs. R. 36. Characteristics: Overall length, 672 ft. 2 in; diameter, 78 ft. 9 in.; height from bumping bags under cars to top of hull, 91 ft. 7 in.; cubic capacity, 2,200,000 cu. ft.

See also Automobile Fuels, Alcohol.

ALLOY STEELS

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ALLOYS

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ALUMINUM

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ALUMINUM ALLOYS.

Uses. Aluminum and Its Alloys in Engineering, John G. A. Rhodin. Engr., vol. 131, nos. 3410-3413, May 6, 13, 20 and 27, 1921, pp. 488-489,501,559,and 531-532. Electrothermic production of aluminum bronze; properties and uses; uses of aluminum in brass; wiredrawing of aluminum alloys.

AMMONIA COMPRESSORS

Performance. Compressor Performance, John E. Starr. Ice & Refrigeration, vol. 60, no. 6, June 1921, pp. 427-430. Records of performance of compressors in reliquefying ammonia. Comparative test of York and De La Vergne compressors.

APPRENTICES, TRAINING OF

Methods. Training Machine Shop Workers, George A. Seyler. Iron Trade Rev., vol.68, no. 20, May 19, 1921, pp. 1391-1392. Operation of training department in plant of Lunkenheimer Co., Cincinnati.

Research. Research on Education of Workmen (Essai d'éducation ouvrière), M. A. Bostsarron. Revue de Métallurgie, vol. 18, no. 3, Mar. 1921, pp. 163-179, 5 figs. Experimental studies conducted by French Forge Co. in training of apprentices from ages of 12 to 18 yr.

AUTOMOBILE ENGINES.

Flywheels. Machining Nash Flywheels, Edward K. Hammond. Machy. (N.Y.), vol. 27, no.10, June 1921, pp. 954-959, 3 figs. Use of vertical automotic lathes for finishing all surfaces at two settings of work.

Manifolds. Disc grinding Manifolds for Automobile Engines, J. H. Moore. Can. Machy., vol. 25, no. 22, June 2, 1921, pp. 25-28, 7 figs. Notes on grinding gear covers, manifolds, cast-iron pipe flanges, drop-forged parts, cast-iron tanks and car brasses.

Steam. The Stanley Steam Car Power Plant, Fred H. Colvin. Am. Mach., vol. 54, no.22, June 2, 1921, pp. 955-958, 9 figs. Boiler is of fire-tube type having drawn shell. Steam pressure of from 575 to 600 lb. per sq. in. is normally carried.

Testing. Routine Factory Tests and Final Inspection of Packard Engines, J. Edward Schipper. Automotive Industries, vol. 44, no, 22, June 2, 1921, pp. 1102-1103 2 figs. Operations include five-hour running-in during which engine is driven by electric motor and two hour dynamometer test in silent room, where measurements of power developed, compression pressure of each cylinder, fuel consumption, etc. are made, and noises are located.

AUTOMOBILE FUELS.

Alcohol. Power Alcohol: Its position and Prospects, T. Baker. Sci. & Industry, vol. 2, no. 2, Feb. 1920, pp. 95-100. Report of Power Alcohol Committee appointed by Australian Advisory Council of Science & Industry.

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Economical Use. Elements of Automobile Fuel Economy, W. S. James. Jl. Soc. Automotive Engrs., vol. 8, no. 6, June 1921, pp. 543-562, 21 figs. Analytical study of factors affecting amount of power supplied car as fuel to produce at road power required for transportations. Graphs are given which show relations between characteristics of engine and power developed, also between fuel consumption and power developed under various conditions.

See also Aeroplane Engines, Fuels, Gasoline.

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Soaring Flight. Experimental Studies of Soaring Flight (Études expérimentales sur le vol à voile), M. Idrac. Comptes rendus des Séances de l'Académie des Sciences, vol. 172, no. 19, May 9, 1921, pp. 1161-1164, 1 fig. Graphical record of vertical components of forces acting on flying kite.

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BEAMS.

Concrete. Design of simple Reinforced Concrete Structural Members—II, Harold W. Barker. Concrete, vol. 18, no. 6, June 1921, pp. 285-287, 3 figs. Formulas for computing shear and bond stresses in beams.

BEARINGS, BALL.

Electric Cars. Destructive Effect of Current on Ball Bearings of Electric Cars, Hilding Angstrom. Elec. Ry. Jl., vol. 57, no. 21, May 21, 1921, pp. 941-944, 13 figs. Tests made under various conditions show that very rapid destruction of ball bearings results from electric current which flows through them. Types of construction are suggested for overcoming trouble and testing apparatus is described for reproducing conditions as they occur in service.

Standardization. International Ball Bearing Standardization, R. S. Burnett. Jl. Soc. Automotive Engrs., vol. 8, no. 6, June 1921, pp. 577-578. Proposed international standardization.

BENZENE.

Still. A New Type of Benzene Still in European Operation, A. Thau. Chem. œ Metallurgical Eng., vol. 24, no. 23, June 8, 1921, pp.1013-1017, 11 figs. Tubular type Bamag benzene still. Still consist of number of horizontally arranged cylinder sections joined by flanged branches.

BLAST-FURNACE GAS.

Cleaning. Notes on the Cleaning of Blast-Furnace Gas, S. H. Fowles. Iron & Steel Inst., annual meeting, May 5-6, 1921, advance paper no. 4, 21 pp. 7 figs. Calculations involved in design of Halberg-Beth dry-gas-cleaning plant. Comparison of Halberg-Beth plant with other plants.

BLAST-FURNACES.

Auxiliary Equipment. Machinery for Pig-Iron Beds at Blast Furnaces, F. W. Broy. Iron & Coal Trades Rev., vol. 102, no. 2777, May 20, 1921, pp. 689-690, 7 figs. Deals with pig breakers, crane for carrying breaking hammer and delivery magnets, and utilization of crane equipment. Translated from Zeit. des Vereines deutscher Ingenieure.

Cowper Stoves. Regulation of Pressure in Cowper Apparatus (Du régime des pressions dams les appareils Cowper), M. J. Seigle. Revue de Métallurgie, vol. 18, no. 3, Mar. 1921, pp. 140-146, 11 figs. Graphs for determining air pressure at various points of apparatus.

Hot-Blast Stoves. Design and Proportions of Hot Blast Stoves, W. E.Groume-Grjimailo. Iron Age, vol. 107, no. 23, June 9, 1921, pp. 1527-153 0, 15 figs. Consideration of laws governing circulation of gases while heating and cooling. Historical designs reviewed.

Heat Distribution in Hot Blast Stoves, W. E. Groume-Grjimailo. Iron Age, vol. 107, no. 24, June 16, 1921. pp. 1613-1616, 3 figs. Hot-blast temperature equalizers. Analysis of performance results. Calculations of convections velocities.

Slags. Blast Furnace and Cupoa Slags, J. E. Fletcher. Iron & Steel Inst., annual meeting, May 5 – 6, 1921, advance paper no. 3, 20 pp. 12 figs. Their composition and graphic methods for determining their constitution.

BOILER FEEDWATER

Treatment. New Boiler Feed Water System. Blast Furnace & Steel Plant, vol. 9, no. 6, June 1921, pp. 392-394, 2 figs We-Fu-Go system, which consists of two reaction-settling tanks holding 80 000 gal. each, equipped with mechanically operated stirring devices, driven by individual motors.

BOILER OPERATION

Boiler Capacity. Burning more Coal to increase Boiler Capacity, Thomas Wilson. Power, vol. 53, no. 23, June 7, 1921, pp. 924-927, 2 figs. Increasing boiler capacity by enlarging grate area, by adding to length or width of stoker, or by using forced-draft stokers. Practice of Commonwealth Edison Co.

Feeding. Boiler Feeding by gravitation. Engr., vol. 131, no. 3410, May 6, 1921, pp. 491-492, 4 figs. Auto-thermal feeding system.

Stoker Firing. Changing a Hand-Fired to a Stoker-Fired Plant, Charles T. Main. Power, vol. 53, no. 24, June 14, 1921, pp. 954-957, 4 figs. Installation of twelve 3500-sq. ft. water tube boilers.

BOILERS

Bettington. Pulverized Fuel Boiler. Eng. Rev., vol. 34, no. 11, May 1921, pp. 288-289, 2 figs. Bettington boiler designed to burn pulverized coal.

Electrically Operated. Electrically Heated Steam Boilers, Eric A. Lof. Gen. Elec. Rev., vol. 24, no. 6, June 1921, pp. 515-518, 3 figs. Comparison of relative heating values of fuel and electric heat. Installation of electrically operated boilers in Sweden.

Marine. *See Marine Boilers.*

BOILERS, WATER TUBE

Yarrow. The Water Drums of Yarrow Boilers. Engr., vol. 131, no. 3413, May 27, 1921, pp. 566-567, 6 figs. Types recently developed.

BOLTS

Industry. Development of the Bolt and Nut Industry. F. H. Chapin. Iron Age, vol. 107, no. 24, June 16, 1921, pp. 1609-1610. First machine-fabricated product made in this country only 80 yrs. ago.

BONUS SYSTEMS

Railway Work. Piece-Work, Bonus, Systems and Higher Efficiency, C.C.Cook. Ry. Age, vol. 70, no. 22, June 3, 1921, pp. 1263-1264. Experience of Baltimore & Ohio Railroad.

BRAKES

Cranes, Tests. Testing equipment for Pneumatic Motors, J. V. Hunter. Am. Mch., vol. 54, no. 21, May 26, 1921, pp. 894-896, 4 figs. Importance of performance records for portable air motors. Examples of testing equipment in several railroad shops.

Double-Capacity. Virginian Demonstration of Double-Capacity Brake. Ry. Age, vol. 70, no. 24, June 17,1921, pp. 1407-1410, 8 figs. Brakes for 120-ton cars. Characteristic is that equipment provides for same percentage of braking force (ratio of total shoes pressure to car weight) on loaded car as on empty car.

Stresses. Piston Travel and Shoe Clearance, H. M. P. Murphy. Elec. Ry. Jl. ,vol. 57, no. 25, June 18,1921, pp. 1119-1122, 10 figs. Study of forces developed in brake riggings. Determination of relation between piston travel and shoe travel.

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Season Cracking. Season-Cracking of Brass, H. Moore, S. Beckinsale and Clarice E. Mallinson. Chem. & Metallurgical Engr., vol. 24, no. 22, June 1, 1921, pp. 976-980, 7 figs. Investigation at Woolwich Arsenal, England, on action of corrosive agents on stressed brasses and determination of minimum loads required to produce corrosion cracks. Chemical action was found to be necessary for season cracking. (Abstract). Paper read before Inst. of Metals.

BRASS FOUNDING

Small Castings. How Small Brass Castings are Made, Raymond H. Sullivan. Foundry, vol. 49, no. 12, June 15, 1921, pp. 490-493, 13 figs. Description of methods involved in planning production and of routine work incidental to molding, pouring, melting and cleaning castings.

BRIDGE DESIGN

Swing Bridges. A Short Method for Swing Bridge Calculations, Charles A. Ellis. Eng. News-Rec., vol. 86, no. 23, June 9, 1921, pp. 981-983, 7 figs. Statically indeterminate stresses found from determinate cases of loading by multiplying by ration of influence.

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Bearing Power of Soils. Design of Foundations for Highway Bridges, L. N. Edwards. Contract Rec., vol. 35, no. 23, June 8, 1921, pp. 583-587. Study of bearing power of soils and of methods and operations involved in design and construction of bridges.

BRIDGES, CONCRETE

Long-Span. Reinforced Concrete Bridges of Long Span (Les ponts à grandes portées en béton armé), A. Vierendeel. Génie Civil. vol. 78, no. 16, April 16, 1921, pp. 336-338, 7 figs. Vierendeel system of 56 meters span at Louvière, Belgium.

BRIDGES, LIFT

Comparison with Other Types. Lift Bridges Compared with Other Movable Forms. J. A. L. Waddell and Ernest E. Howard, Ry. Age, vol. 70, no. 24, June 17, 1921, pp. 1391-1394, 3 figs. Economics of movable spans. Elements in design of vertical lift bridges.

BRIDGES, RAILWAY

Design. The Application of Tables of Equivalent Uniformly Distributed Loads to Square and Skew Bridges Respectively, Conrad Gribble. Ry. Engr., vol. 496, May 1921, pp. 172-174, 9 figs. Graphs for computing stresses.

BUILDING CONSTRUCTION

Labor Hours. Labor Hours Per Output Unit in Building Construction, Frank E. Barnes, Eng. News-Rec., vol. 86, no. 21, May 26, 1921, pp. 888-891. Tables showing time required to accomplish unit of carpenter work, masonry, excavation, painting, plastering, and sheet metal work.

BUILDINGS

Concrete, Surface Treatment. Treatment of Exterior Surfaces of Industrial Buildings. Concrete vol. 18, no. 6, June 1921, pp. 263-265. Classification of surface treatments and suggestions in regard to Method to follow in a given case. Committee Report of Am. Concrete Inst.

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CABLES, ELECTRIC

Suspended. Determination of Tension in Cables (Note sur la détermination des tensions des cables). Marius Bourseire. Revue générale de l'Électricité, vol. 8, no. 19, Nov. 6, 1920, pp. 638-644, 11 figs. Formulas for determining tensile stresses in suspended cables.

CAR DUMPERS

Gravity. Rotary Car Dump that Operates Solely by Gravity. Coal Age, vol. 19, no. 24, June 16, 1921, pp. 1074-1076, 4 figs. Gravity, springs and flywheels discharge cars by revolving them through approximately 135 deg. Cars can be dumped in full trips, hence swivel couplings are not needed.

CAR WHEELS

Cast-Iron. Proposed Tentative Specifications for Cast-Iron Car Wheels. Am. Soc. for Testing Matls., paper of annual meeting, June 21-24., 1921, 4 pp.

CARS

Repairs. Scheduling Car Repairs Incresaes Shop Output, E. T. Spidy. Ry. Mech. Engr., vol. 95, no. 6, June 1921, pp. 349-352, 2 figs. Outline of schedule applicable to passenger or freight car repair work in large or small shops.

CARS, COAL

Hopper. A 70-Ton Hopper Car that can be repaired in any Shop, H. Idoine. Ry. Rev., vol. 68, no. 24, June 11, 1921,pp. 894-899, 14 figs. Steel hopper car of 70-tons capacity built with interchangeable sheets and stakes.

100-Ton. Development of Coal Cars on the Norfolk & Western. Ry. & Locomotive Eng., vol. 34, no. 6, June 1921, pp. 160-163, 7 figs. Details of construction of 100-ton coal car.

Six-Wheel Trucks. New Designs of Buckeye Six-Wheel Trucks. Ry. Age, vol. 70, no. 22, June 3, 1921, pp. 1269-1270' 3 figs. Equalization of load is accomplished by use of equalizer casting which engages center journal.

CARS, PASSENGER

Design. On the Question of Passenger Carriages (Subject VII for discussion at the Ninth Congress of the International Railway Association),F. de Vargas, Bul. Int. Ry. Assn., vol. 3, no. 5, May 1921,pp. 461-506, 18 figs. Trend of developments in design of passenger cars by European and American railways since 1914.

CENTRAL STATIONS

Industrial Heating. Industrial Heating and the Central Station, E. H. Horstkotte. Gen. Elec. Rev, vol. 24, no. 6, June 1921, pp. 579-582, 8 figs. Survey of progress in utilization of electric heating industry.

Load Equalization. Load Equalization, F. L. Stone and T. W. Kennedy. Gen. Elec. Rev., vol. 24, no. 6, June 1921, pp. 501-504, 6 figs, . Study based on typical cases, notably power house supplying five mines.

Steel Mills. Steel Mill Power-Factor and the Central Station, A. K. Bushmand and A. L. Lemon. Gen. Elec. Rev., vol 24, no. 6, June 1921, pp. 483-486, 5 figs. Relation between full-load lower factor on number of poles of induction motor.

The Use of Central Station Power in Mines and Steel Plants, K. A. Pauly. Gen. Elec. Rev., vol. 24, no. 6, June 1921, pp. 479-483. Notes on choise of frequency.

Superpower. Clydes Mill Station of the Clyde Valley Power Co. Elecn., vol.86, no. 2246, June 3, 1921, pp. 686-689, 5 figs. Interconnection of steam-electric plants in and around Glasgow, Scotland.

The Superpower System—Its Scope and Relation to the United States Government, S. W. Murray Nat. Elec. Light Assn. Bul., vol. 8, no. 6, June 1921, pp. 335-341, 1 fig. Legal, financial and economical considerations.

CHUCKS

Magnetic. Magnetic Chucks—VIII, Ellsworth Sheldon. Am. Mach., vol. 54, no. 22, June 2, 1921, pp. 945-948, 9 figs. Description of Persons-Arter chuck.

CIRCUIT BREAKERS

Oil. Rupture Capacity of Oil Interrupters (Un critérium de la capacité de rupture des disjoncteurs à huile), P. Charpentier. Revue générale de l'Électricité, vol. 9, no. 20, May 14, 1921, pp. 687-693, 3 figs. Empirical method of computing diagrams.

COAL CLEANING

Dry Process. Dry Cleaning of Coal by Means of Tables, Edward O'Toole. Am. Iron & Steel Inst., advance paper, May 27, 1921, 28 pp. 23 figs. Results of table tests of Indiana and Illinois coals.

See also Coal Washing.

COAL MINING

Losses of Coal. Factors Affecting Losses of Coal in Mining, George S. Rice. Coal Industry, vol. 4, no. 5, May, 1921, pp. 249-252. Report of investigations of U. S. Bur. of Mines as to waste in recovering coal.

COAL TIPPLES

Steel. Hillsboro Wood Tipple Replaced by Steel White Shaft is Hoisting Coal, John A. Garcia. Coal Age, vol. 19, no. 19, May 12, 1921, pp. 857-860, 6 figs. Steel structure equipped with pendulum-hung three-track shaker screen, weigh pan, picking table, loading boom and like equipment.

COAL WASHING

Froth Flotation. Froth Flotation as Applied to the Washing of Industrial Coal, Ernest Bury, Walter Broadbridge and Alfred Hutchison. Can. Min. Jl., vol. 42, no. 20, May 20, 1921, pp. 405-410, 4 figs. Also in Iron & Steel of Canada, vol. 4, no. 4, May 1921, pp. 112-119, 4 figs. Results of tests. Economic aspect of process. Paper read before Instn. Min. Engrs.

COKE

Metallurgical. Study of the Efficient Use of Metallurgical Cokes (Contribution à l'étude de la valeur des cokes métallurgiques), G. Deadrière. Revue universelle des Mines, vol. 9, no. 2, April 15, 1921, pp. 93-107.) Writer terms "use value" of a fuel the price which must be paid for fuel when it is substituted by another fuel, in order to effect with the former the same industrial operation that is performed with latter. Formula for use values of metallurgical cokes is developed.

COKE BREEZE

Utilization. Value of Mixtures of—Coke Breeze and Bituminous Coal as Fuel a for Hand-Fired Boiler, John Blizard and James Neil. U. S. Dept. of Interior Reports of Investigations, Bur. of Mines, serial no. 2244, May 1921, 27 pp. 3 figs. Tests carried out at request of Chamber of Commerce of Pittsburgh. in order to determine steaming value of coke breeze as fuel when mixed with Pittsburgh coal and fired by hand, and to see whether mixture when burnt would give off objectionable quantity of smoke.

COKE OVENS

By-Product. By-Product Coke Ovens and Their Relation to our Fuel Supply, E. B. Elliott. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 26, no. 4, May 1921, pp. 381-400, 6 figs. Relative efficiencies in furnaces of coke and coal.

By-Products of Coal Distillation. Process of Extraction and Installations of Marine and d'Homécourt, Forging and Steel Manufacturing Co. at Boucau Works, France (Les produits de distillation de la houille. Précédés d'extraction et installations de la Cie des Forges et Aciéries de la Marine et d'Homécourt aux usines du Boucau (Basses-Pyrénées), A Grebel. Génie Civil, vol. 78, no. 22, May 28, 1921, pp.449-454, 15 figs. partly on supp. plate. Benzol recovery and tar distillation.

COKE PLANTS

By-Products of. Developments in the Recovery and Treatment of By-Products from Carbonization of Coal (L'Évolution dans la récupération et le traitement des sous-produits de la carbonisation de la houille), Ch. Berthelot. Chimie & Industrie, vol. 5, nos. 4 and 5, April and May 1921, pp.384-397, and 508-517, figs. 23, 12 figs. Study of recent developments and possibilities in increasing recovery of ammonia sulphate and benzol. Methods for recovery and treatment of benzol.

COLUMNS

Concrete. The design of Column and Wall Forms, E. F. Rockwood. Eng. & Contracting, vol. 55, no. 21, May 25, 1921, pp. 528-529, 1 fig. Chart for designing vertical members subject to horizontal pressures.

Fire Tests. Fire Tests of Building Columns, S. H. Ingberg, H. K. Griffin, W. C. Robinson and R. E. Wilson. U. S. Dept. of Commerce, Technologic Papers of Bur. of Standards, no. 184, April 21, 1921, 375 pp. 171 figs. Purpose of investigation was to ascertain ultimate resistance against fire, of protected and unprotected columns as used in interior of buildings, and their resistance against impact and sudden cooling from hose streams when in highly heated condition.

COMBUSTION

Control. The Scientific Control of Combustion, H. T. Ringrose. Iron & Steel Inst., annual meeting, May 5-6, 1921, advance paper no. 8, 9 pp. 5 figs. Use of recording apparatus for controlling combustion.

Draft Influence. Draft and CO_2 Influence on Evaporation, James T. Beard, Jr. Power, vol. 53, no. 20, May 17, 1921, pp. 775-777, 3 figs. Graphs showing relation between combustion rate and draft for various fuels.

COMPRESSED AIR

Measurement. Measuring Compressed Air Consumption in Pneumatic Tools, M. Piette. Colliery Guardian, vol. 121, no. 3149, May 6, 1921, p. 1315, 3 figs. Apparatus consisting of a venturi tube 1 in. in diameter and provided with constriction. For measuring compression of air differential gage is mounted on venturi tube.

Metering. The Metering of Compressed Air, John L. Hodgson. Mech. World, vol. 69, no. 1794, May 20, 1921, pp. 387-388, 10fi figs. Installation in goldmines at Witwaterstrand, So. Africa. Paper read before Midland Inst. Min., Civil & Mech. Engrs.

CONCRETE

Alkali Action. Progress in Investigation of Alkali Action on Concrete, E. C. Bebb. Eng. World, vol. 18, no. 6, June 1921, pp. 391-393. Investigations of advisory committee appointed by Bur. of Standards Reclamation Service, Drainage Investigations Office of Dept. of Agriculture and Portland Cement Assn.

Consistency. A Comparison of the Results of the Slump Test and the Flow Table in the Measurement of the Consistency of Concrete, W. L. Schwalbe. Am. Soc. for Testing Matls., paper of annual meeting, June 21-24, 1921, 6 pp. 4 figs. It is concluded that relative consistencies are more truly indicated by flow table for greater range of consistencies than by slump test.

Crusher Screenings. Effect of Crusher Screenings in Concrete. Can. Engr., vol. 40, no. 21, May 26, 1921, pp. 500-502, 1 fig. Tests carried out by Milton Hersey Co., Montreal, for Crushed Stone Corporation Dundas, Ont.. Increase in Strength of concrete through use of up to 20 per cent of crusher screenings is reported.

Mixer. Pneumatic Concrete Mixer for Jap Tunnel. Public Works, vol. 50, no. 22, May 28, 1921, pp. 452-454, 1 fig. Special compressed-air machine designed for lining Imperial Japanese Government Railways tunnel.

Proportionating Aggregates. A Proposed Method of Estimating the Density and Strength of Concrete and of Proportioning the Materials by the Experimental and Analytical Consideration of the Voids in Mortar and Concrete, Arthur N. Talbot. Am. Soc. for Testing Matls., paper of annual meeting, June 21-24, 1921, 29 pp. 9 figs. Characteristic mortar curves giving relation between mortar voids and ratio of fine aggregate of cement, both for basic water content and for water contents in excess of this. Analytical relations developed from characteristic curves for determining proportions of cement, fine aggregate and coarse aggregate for concrete of required density and strength.

Sea-Water Action. Effect of Sea Water on Concrete Structures. Cement & Eng. News., vol. 33, no. 5, May 1921, pp. 29-30, 1 fig. Experience with piers at Annapolis Royal, Nova Scotia.

Testing. Report of Committee C-9 on Concrete and Concrete Aggregates. Am. Soc. for Testing Matls., paper of annual meeting, June 21-24 1921, 19 pp. Proposed tentative methods for making compression tests of cement concrete, test for organic impurities in sands, test for sieve analysis of aggregates, and for screening specimens of hardened concrete from structure; also proposed tentative specifications for concrete aggregates.

Water Content. Mathematical Determinations of Water Content of Mortars and Concrete, According to the New Theories on Their composition and on the Rôle Played by Their Various Elements (le dosage mathématique, en eau, des mortiers et bétons, d'après les nouvelles théories sur leur composition et sur le rôle de leurs divers éléments). J. Boudet, Vie technique & Industrielle, vol. 2, no. 19, April 1921, pp. 39-45, 5 figs. Graphs.

CONCRETE REINFORCED

Wood Reinforcement. Wood reinforcements of cement (Le béton armé de bois), M .Levatel. Outillage, vol. 5, no. 10, Mar. 10, 1921, pp. 283-284, 10 figs. Experiments show that wood reinforcements are effective wood being preserved perfectly for indefinite time.

CONDENSERS, STEAM

Water Films. The Water Film on Evaporating and Condensing Tubes, P. H. Parr, Engr., vol. 131, no. 3413, May 27, 1921, pp. 559-561. Internal resistance of water film.

CONDUITS

Steam Pipe. Steam Conduit for Toronto's New Union Station. Contract Rec. vol. 35, no. 22, June 1, 1921, pp. 551-552, 4 figs. Two pipe lines in concrete tunnel convey steam from power house, several blocks distant. Provision for removal of seepage.

COPPER

Thermal Expansion. Thermal Expansion of Copper and Some of its Important Industrial Alloys, Peter Hidnert. U. S. Dept. of Commerce, Scientific Papers of Bur. of Standards, no. 410, Mar. 21, 1921, pp. 91-170, 43 figs. Data on thermal expansion of 128 samples of copper and its important industrial alloys of various compositions, heat treatments, mechanical treatments, etc. Samples were examined from room temperature to about 300 deg. cent.

CORES

Core Oils. Tests Show the Quality of Core Oils, R. F. Harrington. Foundry vol. 49, no. 11, June 1, 1921, pp. 447-448, 3 figs. Tests used by manufacturers of core oil to determine character of various ingredients are described. Effect of core oil varied by use of dry or wet sand.

CORROSION

Iron in Concrete. The Corrosion of Iron and Steel with special Reference to Reinforced Concrete, J. Newton Friend. Concrete Inst. Trans., vol. 9 Apr., 1921, pp. 1-15 and (discussion) pp. D15-D20, 3 figs. It is shown that preservation of iron in concrete may be effected in one or more of three ways, namely by complete exclusion of air, of water, and by rendering concrete sufficiently alkaline to place it within the protective area. Suggestions are offered.

CUTTING TOOLS

Design. Metal Cutting Tools—X and XI, A. L. DeLeeuw. Am. Mach., vol. 54, nos 21 and 23, May 26 and June 9, 1921, pp. 897-902, 13 figs., and 985-990, 13 figs. May 26. Notes on design of milling cutters, gear cutters, duplex cutters and various types of hobs. June 9: Cutter sharpening; characteristics of cup and disk wheels; importance of correct angles; cutter grinders; hob grinding.

D

DAMS

Diversion. Design and Construction Features of the Kerckhoff Dam, B. F. Jakobsen. Eng. & Contracting, vol. 55, no. 23, June 8, 1921, pp. 565-568, 10 figs. Diversion dam with about 4000 acre feet of storage of which about 3000 acre feet are available for power house.

Earth-Fill. Earth Fill Irrigation Dam has some Novel Details, Clair V. Mann. Eng. News-Rec., vol. 86, no. 24, June 16, 1921, pp. 1030-1032, 4 figs. Loose rock drains lower saturation line. Air vents added to sluiceways permit trapped air to escape.

DIESEL ENGINES

Oil-Fuel Injection. Injection and Combustion of Fuel-Oil, C. J. Hawkes. Motorship, vol. 6, no. 6, June 1921, p. 483, 3 figs. Experiments with solid injection and air-blast in marine Diesel engines. (Continuation of Serial)

Standardization. Standardized Diesel Engines—IV, H. R. Setz. Mar. Eng.,vol. 26, no. 6, June 1921, pp. 471-476, 11 figs. Description of engine with automatic valve-port scavenging arrangement.

DRAWINGS

Filing. Indexing and Filing Industrial Drawings, L. H. Park. Iron Age, vol. 107, no. 22, June 2, 1921, pp. 1447-1149, 1 fig. System used by prominent engineers and manufacturers.

DREDGES

Bucket. Design of Bucket Dredges, Alexander Kari. Shipbuilding & Shipping Rec., vol. 17, no. 18, May 5, 1921, pp. 543-544, 2 figs. Formulas for computing dimensions.

DREDGING

Tests. Tests of Dredge Pump Operation for Hydraulic Fill, Ivan E. Houk. Eng. News-Rec., vol. 86, no. 24 June 16, 1921, pp. 1034-1037, 3 figs. Velocities and power consumption decreased as friction head and solids increades.

DRILLING MACHINES

Radial. Carlton Heavy-Duty Ball Bearing Radial Drill Machine, J. V. Hunter. Am. Mach., vol. 54, no. 21, May 26, 1921, pp. 908-911, 6 figs. Heavy-duty, geared radial drilling machine made by Carlton Machine Tool Co., Cincinnati.

DRYING

Technology. The Symposium on Drying, W. K. Lewis, W. H. Carrier, A. E. Stacey, Jr., R. S. Fleming, Robert G. Merz and Grahame B. Ridley. Jl. Indus. & Eng. Chemistry, vol. 13, no. 5, May 1921, pp. 427-460, 55 figs. Titles of papers were: The Rate of Drying of Solid Materials. The Theory of Atmospheric Evaporation - With Special Reference to Compartment Dryers. The Compartment Dryer, The Spray Process of Drying, Direct Heat Rotary Drying Apparatus and Tunnel Dryers.

E

EDUCATION, ENGINEERING.

Industrial Training. Requirements of the Engineering Industries and the Education of Engineers, Magnus W. Alexander. Mech.,Eng., vol. 43, no. 6, June 1921, pp. 391-395 and 397, Developments in organization of co-operative engineering courses in connection with manufacturing plants. Plan organized at Mass. Inst. of Technology and Lynn Works of Gen. Elec. Co. During their assignements at works, students are subject to usual rules and regulations applying to employees of Gen. Elec. Co.

EDUCATION, INDUSTRIAL.

Steel Industry. Educational Work in the Wire Industry, Charles R. Sturdevant. Iron Age, vol. 107, no. 22, June 2, 1921, pp. 1460-1462. Courses on salesmanship, Americanization and for foremen, being given by Am. Steel & Wire Co., Cleveland. Paper read before Am. Iron & Steel Inst.

ELECTRIC CIRCUITS, A. C.

Interconnection. Graphical Calculation of Interconnected A. C. Circuits, A. S. McAllister. Elec. World, vol. 77, no. 24, June 11, 1921, pp.1359-1363, 13 figs. Application of standard methods to circuits of polyphase and single-phase induction motors

ELECTRIC DISTRIBUTION.

Rural Districts. Distribution Service in Rural Districts, Edward N. D'Oyly and C. S. Kennedy. Elec. World, vol. 77, no. 22, May 28, 1921, pp. 1241-1243, 3 figs. Symposium. Titles of papers are: Serving Dense Irrigation Load in California and Rural Lines Owned by Farmers.

ELECTRIC DRIVE.

Air Compressors. Motor Drives for Air Compressors, Gordon Fox. Power, vol. 53, no. 20, May 17, 1921, pp. 778-779, 3 figs. Types of air compressors, their limitations, power requirements and operating characteristics. Motors to use for different applications.

Flour Mills. Electric Drive for Flour and Grist Mills, W. T. Edgell, Jr. Gen. Elec. Rev., vol. 24, no. 6, June 1921, pp. 542-546, 3 figs. Operating data obtained in existing installations.

Machine Shops. Electric Drive for Machine Shops, B. S. Pero. Gen. Elec. Rev., vol. 24, no. 6, June 1921, pp. 528-529, 2 figs. Types of motors used.

Machine Tools. Installation of Motor Drives on Old Tools, J. H. Vincent. Am. Mach., vol. 54, no. 23, June 9, 1921, pp.100-101, 3 figs. Expedients resorted to in railroad shop to provide individual motor drive for old planer and boring mill.

Skip Hoists. Electric Drive for Small Automatic Self-Dumping Skip Hoists, R. H. McLain and C. B. Connely. Gen. Elec. Rev., vol. 24, no. 6, June 1921, pp. 530-535, 13 figs. Notes on design of installations.

Steel Mills. Load Conditions in Steel Mills, J. D. Wright and L. C. Moseley. Gen. Elec. Rev., vol. 24, no. 6, June 1921, pp. 487-490, 8 figs. Typical load curves.

Woodworking Industry. Motor Drive in the Woodworking Industry, F. H. Penney and E. L. Bamforth. Gen. Elec. Rev., vol. 24, no. 6, June 1921, pp. 554-557, 5 figs. Types of electrically-driven machines used in wood-working industry.

ELECTRIC FURNACES.

Crucible vs. Electric vs Crucible Furnaces, H. W. Gillet and T. H. A. Eastick. Metal Industry (N. Y.), vol. 19, no. 6, June 1921, pp. 240-242. Opinions of Bureau of Mines experts on opposite sides of question.

ELECTRIC PLANTS.

Interconnection. Interconnection Problems and Economies, E. P. Peck and Harry J. Burton. Elec. World, vol. 77, no. 22, May 28, 1921, pp. 1238-1240, Symposium. Titles of papers are: Charts for Quick Solution of Line-Drop Problems; Conditions that Must Be Watched When Inter-connecting Small Plants; and Economic Benefits Derived from Energy Interchange.

Protective Equipment. Protection of Power-Station Equipment, Edgar P. Slack. Power, vol. 53, no. 23, June 7, 1921, pp. 920-923, 3 figs. National Electrical Code as applied to power-station equipment.

ELECTRIC GENERATORS, A. C.

Temperature Limits. Temperature Limits of Large Alternators, G. A. Juhlin. Jl. Instn. Elec. Engrs., vol. 59, no. 299, Mar. 1921, pp. 281-293 and (discussion) pp. 293-318, 14 figs. Existing practice of specifying temperature-rise of electrical machinery by thermometers. Relations between surface tempertures and internal or hot-spot temperatures, together with influence of load on temperatures of different parts of machine. Results of bending tests on bar before and after heating.

ELECTRIC RAILWAYS.

Indianapolis-Louisville Interurban. Developing and Electric Railroad. Elec. Ry. Jl., vol. 57, no. 23, June 4, 1921, pp. 1026-1031, 10 figs. Deals with improvement of Indianapolis-Louisvile Interurban. Features of new steel motor cars and rebuilt trailers for use in high-speed limited service.

ELECTRIC RAILWAYS, TRACK.

Characteristics. Measurement of Track Circuit Characteristics, R. M. Gilson, Ry, Signal Engr., vol. 14, no. 6, June 1921, pp. 216-218, 2 figs. Consideration of ballast condition and rail resistance in calculations of d.c. and a.c. track circuits.

ELECTRIC TRANSMISSION LINES.

Design. The Economic Design of High Tension Transmission Lines, W. P. Dobson Elec. News, vol. 30, no. 10, May 15, 1921, pp. 36-38, 2 figs. Chart for determining economic section of conductor, whether of copper or of aluminum.

Surge Protection. Surge Protection on Transmission Lines and Cables, S. Cunha and G. C. Read. Jl. Eng. Inst. of Canada, vol. 4, no. 6, June 1921, pp. 335-345, 18 figs. Surge protection used by Montreal Light Heat & Power Co. Company operates four hydraulic plants, one steam station for emergency use and purchases from other companies considerable power. Net work comprises about 80 mi. of 12,000-volt underground cable and 76 mi. of 12,000-volt overhead tie and distribution lines.

ELECTRIC WELDING ARC.

Automatic. Automatic Arc Welding, H. L. Unland. Gen. Elec. Rev.,vol. 24, no. 6, June 1921, pp. 583-586, 5 figs. Apparatus developed for automatic welding by electric arc.

ELECTRIC WELDING RESISTANCE.

Modern machines. Recent Progress in the Construction of Electric Welding Machines (Neuere Fortschritte im Bau elektrischer Schweissmaschinen), Albert Neuburger. Werkstattstechnik, vol. 15, no. 9, May 1, 1921, pp. 250-255, 8 figs. Details of various improved types of machines for spot, butt and seam welding.

Tests. Resistance Electric Welding (La soudure électrique par résistance), J. Paturel. Vie technique & industrielle, vol. 2, nos. 19 and 20, April and May 1921, pp.24-26, 5 figs., and 137-139, 11 figs. Tests on aluminum and steel articles.

ELECTRICAL MACHINERY.

Testing. The Testing of Electrical Machinery, H.E. Mellor. Elcn.,vol. 86, no. 2244, May 20, 1921, pp. 612-615, Equipment and procedure for conducting static and dynamic tests.

ENAMELS.

Copper. Some Data on the Composition of Arsenic Enamels for Copper, B. T. Sweely Jl. Am. Ceramic Soc., vol. 4, no. 5, May 1921, pp. 350-356. Methods of application by wet slushing.

EVAPORATORS.

Regenerative Compressor. G-R Regenerative Compressor. Power, vol. 53, no.20, May 17, 1921, p. 777, 1 fig. Apparatus designed for installations on Reilly evaporators. Compressors is essentially jet flow compressor that entrains and compresses by means of live steam part of vapor produced by evaporator, and this entrained vapor is in turn led to evaporator coils together with boiler steam.

F

FABRICS.

A.S.T.M. Committee Report. Report of Committee D-13 on Textile Materials. Am. Soc. for Testing Matls., paper of annual meeting, June 21-24, 1921, 8 pp. Proposed tentative definitions of terms relating to mechanical fabric and proposed tentative specifications for imperfections and tolerances for square-woven tire builder fabric.

FACTORY MANAGEMENT.

See Industrial Management

FANS, CENTRIFUGAL.

Design. Some Developments in Centrifugal Fan Design, F. W. Bailey and A. A. Criqui. Jl. Am. Soc. Heat & Vent. Engrs., vol. 27, no. 4, May 1921, pp. 375-380, 7 figs. Comparison of static efficiencies of forward and double-curved-blade types of fans.

FATIGUE.

Insdustrial. Fatigue and Efficiency in Iron and Steel Works—VII, H. M. Vernon and E. A. Rusher. Eng. & Indus, Management, vol. 5, no. 18, May 5, 1921, pp. 519-522. Health of steel workers. Abstract from Report No. 5 of British Indus. Fatigue Research Board.

FIREBRICK.

Spalling. Report of Committee C-8 on Refractories. Am. Soc. for Testing Matls., paper of annual meeting. June 21-24, 1921, 4 pp. Proposed tentative method of test resistance of fireclay brick to spalling action.

FLOW OF OIL.

Pipes. The Flow of Petroleum Oils Through Pipes, W. A. Thomas. Oil News, vol. 9, no. 10, May 20, 1921, pp.33-34. Tables of coefficients in formulas.

FLUE-GAS ANALYSIS

Excess-Air Determination. Determination of Excess Air from Flue Gas Analysis, R. Brown. Combustion, vol. 4, no. 6, June,1921, pp. 24-25, 2 figs. Chart and derivation of formula used in constructing it.

G

GAS MANUFACTURE.

Cleaning. Some Conditions Affecting the Usefulness of Iron Oxide for City Gas Purification, Wm. A. Dunkley. University of Ill. Bul., vol. 18, no. 25, Feb. 21, 1921, 62 pp. 5 figs. It is concluded from experiments that usefulness of iron oxide for gas purification depends upon its physical, and perhaps upon its molecular, structure, rather than upon its iron content.

GASOLINE.

Specifications. Report on Low Test Gasoline Specifications. U.S. War Dept., Air Service Information Circular, vol. 2. no. 165, May 1, 1921, 4 pp.

GEARS.

Blank Manufacture. An improved Method of Making Steel Gear and Wheel Blanks, George Atwell Richardson. Am. Mach., vol. 54, no. 23, June 9, 1921, pp. 981-984, 13 figs. Manufacture of high grade steel gear blanks in hydraulic ram for production work.

Design. Odontograph for Layout out 20-Degree Gear Teeth, J. L. Williamson. Machy. (N.Y.), vol.27, no. 10, June 1921, pp. 929, 1 fig. Table giving calculated valuation of constant.

Involute. Slip of Involute Gear Teeth. A. B. Cox. Am. Mach., vol.54, nos. 21 and 22, May 26 and June 2, 1921, pp. 913-917, 4 figs., and 951-955, 9 figs. Gear efficiency increased and war decreased by using large numbers of teeth. Shorter addendum reduced slip. Friction losses increase with increases in angle of obliquity. Graphs. Diagrams for internal-gear formulas. (To be continued.

The Evolution of the Involute Gear Tooth—V, A. Fisher. Mach. (Lond.) vol. 18, no. 453, June 2, 1921, pp. 273-276, 8 figs. Study of contact conditions

Laminated. The Manufacture of Laminated Gears. Eng. Production, vol. 2, no. 34, May 26, 1921, pp. 653-655, 7 figs. Practice at works of Laminated Gears, Ltd., Sheffield, England.

Machining Operations. Machining a Large Gear Blank on the Automatic, J. H. Moore. Can. Machy., vol. 25, no. 21, May 26, 1921, pp. 71-74, 12 figs. Attachments used. Tool layouts for gear blanks, hubs and spark-plug shells.

Spiral. Chart for Selecting Spiral Gears. Machy. (Lond.), vol. 18, no. 449, May 5, 1921, pp. 141-143, 1 fig. Chart prepared from standard formulas.

GAGES

Screw. The Manufacture of Hardened Screw Gauges. Eng. Production, vol. 2, no. 34, May 26, 1921, pp. 644-645, 3 figs. Machines and processes employed.

GRINDING MACHINES.

Cylinder. Cylinder Grinding Machine. Engineering, vol. 111, no. 2892, June 3, 1921, pp. 676-678, 20 figs. Machines manufactured by Heald Machine Co., Worcester, Mass.

GUN METAL.

Properties. Reviews Properties of Gunmetal, Joseph Horton. Foundry, vol. 49, no.11, June 1, 1921, pp. 436-439. Compositions and physical properties called for in different specifications are compared and views of number of investigators on effects of various metals and heat treatments are cited.

GYPSUM

A. S. T. M. Committee Report. Report of Committee C-11 on Gypsum. Am. Soc. for Testing Matls., advance paper of annual meeting, June 21-24, 1921, 11 pp. Proposed tentative specifications for gypsum, calcined gypsum and gypsum plasters.

A. S. T. M. Committee Report. Specifications for the Color of Gypsum Plasters, Warren E. Emley and Charlotte G. Faxon. Chem. & Metallurgical Eng vol. 24, no. 24, June 15, 1921, pp. 1054-1055, 4 figs. Specifications adopted by Am. Soc. for Testing Matls.

H

HEAT TRANSMISSION

Research. Heat Transmission Investigations, A. J. Wood and E. F. Grundhofer. Jl. Am. Soc. Heat. & Vent. Engrs. vol. 26, no. 4, May 1921, pp. 453-462, 1 fig. Results of study and experimentation on heat transmission through corkboard and air spaces. Work undertaken at Engineering Experiment Station, Pennsylvania State College.

HEATING ELECTRIC

Factories. Air Heating by Electricity in Swiss Factory (Réchauffeur d'air électrique, à accumulation). Génie Civil, vol. 78, no. 18, April 30, 1921, pp. 376-377, 2 figs. Heater has capacity of 3300 kw.

HEATING HOT-WATER

Piping. Circulation Problems in Hot-Water Heating, A. W. Luck. Jl. Am. Soc. Heat. & Vent. Engrs., vol. 26, no. 4, May 1921, pp. 409-416, 7 figs. Typical piping methods.

HOUSES

Stucco. Back-Plastered Stucco House Construction Concrete, vol. 18. no. 6, June 1921, pp. 274-278, 12 figs. Recommendations prepared by Committee of Am. Concrete Inst.

HOUSE, CONCRETE

Economic Construction. "Double C" Elements for Economic Construction of Buildings (agglomérés en éléments dits "double C" pour la construction économique des bâtiments). Génie Civil, vol. 78, no. 18, April 30, 1921, p. 379, 3 figs. Concrete slabs with projecting members. In erecting wall projecting members are placed end to end and fastened together by suitable reinforcing bar.

England. The Development of Concrete for Housing in England. Concrete, vol. 18, no. 6, June 1921, pp.-279-281, 6 figs. Systems of constructing cavity walls. From Concrete & Constructional Eng.

Unit Dwellings. The One-Piece House, Harry A. Mount. Sci. Am. vol. 124, no. 22, May 28, 1921, pp. 424-425, 4 figs. Simon Lake's scheme for producing ready-to-live-in concrete unit dwellings and transporting them to site.

HOUSING

Mines. Rosita, Mexico, a Carefully Planned City; Pleasing, Comfortable and Hygienic—I, Hjalmar E. Skougor. Coal Age, vol. 19, nos. 22 and 23, June 2, and 9, 1921, pp. 983-987, 8 figs.,and 1037-1040, 9 figs. Village for employees at coal mines and by-product plant of Am. Smelting & Refining Co. Each family to have lot 50 ft. square and share in a large community farm.

HYDRAULIC TURBINES

Design. Calculation of the Moment of Inertia of the Flywheel of an Hydraulic Turbine (Calcul du moment d'inertie à donner aux volants des turbines hydrauliques), P. Cayère. Houille Blanche,vol. 20, no. 51-52, Mar-April 1921, pp. 57-63, 10 figs. Formulas and Graphs.

Regulation. Regulation of Hydraulic Turbines (Les turbines hydrauliques et leur régulation). Revue générale de l'Electricité, vol. 9, no. 18, April 30, 1921, pp. 616-623, 7 figs. Survey of developments. (Abstract.) Paper read before Société des Ingénieurs civils de France.

HYDROELECTRIC PLANTS

Canada. Hydro-Electric Plant at Weedon, P.Q., for City of Sherbrooke. Elec. News, vol. 30, no. 10, May 15, 1921, pp. 30-31, 3 figs. Plant will develop 4000 hp. and deliver energy at 50,000 volts along transmission line 28 mi. long.

Design. Hydro-Electric Practice—Features of Design, C. Voetsch. Power vol. 53, no. 21, May 24, 1921, pp. 812-823, 12 figs. Overall efficiency of hydroelectric power system. Effects of main unit sizes upon station efficiency. Importance of specific speed in turbine design. Curves given for checking turbine design or laying out preliminary designs.

Efficiency. How to increase the Efficiency of Existing Water-Power Plants, Charles M. Allen. Jl. Worcester Polytechnic Inst., vol. 24, no. 3, April 1921, pp. 192-200, 1 fig. Graph showing best speed for maximum horsepower at any gate for heads from 25 ft. to 33 ft.

Hydraucone Regainer. The Hydraucone Regainer, Its Development and Applications in Hydroelectric Plants, W. M. White. Mech. Eng., vol. 43, no. 6, June 1921, pp. 375-380 and 419. 17 figs. Device for recovering energy discharged from runner for useful effect on water wheel with in limited space available in powerhouse foundations. Method consists in causing stream flow to impinge upon flat, conical or concave shape, thus changing its direction, and then by means of a gradual diverging envelope placed around this shape to change the velocity head of a fluid entering at high velocity into pressure and low velocity at exit. Results of tests are included.

I

IGNITION

Theory. Underlying principles of Electrical Ignition, Benjamin F. Bailey. Jl. Soc. Automotive Engrs., vol. 8, no. 6, June 1921, pp. 570-576 and 607, 8 figs. Formulas and graphs expressing variations in energy supplied by magneto, produced by changes in engine speed.

IMHOFF TANKS

Chicago Plant. Sewage Treatment Plant for Calumet Region of Chicago Sanitary District, Langdon Pearse. Eng. News-Rec., vol. 86, no. 23, June 9, 1921, pp. 986-988, 5 figs. Imhoff tanks are convertible into activated sludge tanks. Experimental sludge units and sprinkling filter are provided.

Tests. Sewage Disposal at Worcester, Mass. Public Works, vol. 50, no. 21, May 21, 1921, pp. 421-423. Tests on septic and Imhoff tanks, contact filters, trickling filters and activated sludge.

INDUSTRIAL MANAGEMENT

Control of Functions. The Control of Function in Industry. Eng. & Indus. Management, vol. 5, no. 21, May 26, 1921, pp. 597-599. Essential features to be considered when planning a scheme for controlling functions, or duties, of a worker in large organization.

Measurement of Labor Losses. Production Hours—A New Measure of Management, William Leavitt Stoddard. Factory, vol. 26, no. 11, June 1, 1921, pp. 1287-1291, 1 1fig. Plan for accurate measurement of labor losses.

Productions System. Modern Production Methods—XVII, W. R. Basset. Am. Mach. vol. 54, no. 24, June 16, 1921, pp.1032-1036, 4 figs. Illustrates method of handling abnormal expense.

Planning and Controlling Production in a French Shop, E. Julien. Am. Mach. vol. 54, no. 21, May 26, 1921, pp. 889-893, 13 figs. Engineering department responsible for bills of material. Cylindrical control board saves room. Calculagraph used in work distributing department.

Routing Materials. Works Administration, Cecil F. Hammond. Eng. Production, vol. 2, no. 34, May 26, 1921, pp. 647-652, 11 figs. Progress system and its relation to works costing.

See also Time Study.

INSPECTION

System. The Delco Inspection System, Louis Ruthenburg and R. A. Crist. Machy. (N.Y.), vol. 27, no. 10, June 1921, pp. 921-926, 4 figs. Methods used by Dayton Eng. Laboratories Co., for inspection of raw materials, purchased parts, tools, equipment and gages, and manufactured product.

INSULATING MATERIALS

Testing. Testing Insulating Materials—II, John S. Dean. Elec. Ry. Jl., vol. 57, no. 21, May 21, 1921, pp. 931-934, 8 figs. Outline of procedure.

INSULATORS, ELECTRIC

A. S. T. M. Committee Report. Report of Committee D-9 on Electrical Insulating Materials. Am. Soc. for Testing Matls., advance paper of annual meeting June 21-24, 1921, 36 pp. 8 figs. Proposed tentative methods of testing insulating varnishes, electrical porcelain, transformer and switch oils and on molded insulating materials.

INTERNAL-COMBUSTION ENGINES

Cylinder Actions. Cylinder Actions in Gas and Gasoline Engines, Dugald Clerk. Jl. Soc. Automotive Engrs. vol. 8, no. 6, June 1921, pp. 523-539, 24 figs. Account of experiments which have been made to develop theory and establish property of flame working fluid in internal combustion engines. Description of Clerk plane-pressure starter.

Detonation. Detonation in Internal-Combustion Engines, H. T. Tizard. Eng. & Indus. Management, vol. 5, no. 18, May 5, 1921, pp. 515-518. Conditions under which different types of fuel ignite. (To be continued).

Fuels. The Influence of Various Fuels on the Performance of Internal Combustion Engines—V, H. R. Ricardo. Automobile Engr., vol. 11, no. 151, June 1921, pp. 201-205, 9 figs. Tests on variable compression engines. It was found that when both change in specific heat and dissociation are taken into account maximum temperature obtained with economical mixture strengths is substantially the same of all available hydrocarbon fuels, though it is perceptibly lower in case of alcohol; also that gain in efficiency with increase in compression ratio is very considerably greater than is required by air cycle formula.

Temperature-Entropy Diagrams. Temperature-Entropy Diagrams for Gas and Oil Engine Cycles, Guy B. Petter. Engineering, vol. 111, no. 2892, June 3, 1921, pp. 669-670, 9 figs. Examples of method of constructing diagram notes on its interpretation.

See also Aeroplane Engines; Automobile Engines; Diesel Engines; Gas Engines; Oil Engines; Semi-Diesel Engines.

IRON

Basic Open-Hearth. Commercially Pure Iron in the Basic Open-Hearth, W. J. Beck. Chem. & Metallurgical Eng., vol. 24, no. 22, June 1, 1921, pp. 965-968, 3 figs. Notes on development of metallurgical process for producing substantially pure ferrite on tonnage basis, without containing excessive amount of gas. Many modifications in rolling mills and galvanizing department were necessary to make finished sheets. Paper read before Am. Iron & Steel Inst.

J

JIGS

Design. Tool Engineering, Albert A. Dowd and Frank W. Curtis. Am. Mach., vol. 54, nos. 21-24, May 26, 1921, June 2, 9 and 16, 1921, pp. 905-908, 10 figs., 939-942, 7 figs., 997-999, 7 figs. and 1037-1040, 9 figs. May 26: Design of drill jigs, leaf jigs, clamps, etc. June 2: Typical design of jigs and components; standardization of jig posts and thumb screws. June 9; Bushings, June 16. Drill, templets and plates jigs.

L

LABORATORIES

Industrial. A Modern Works Laboratory, Eng. Production, vol. 2, no. 33, May 19, 1921, pp. 620-622, 10 figs. Details of new Laboratory buildings and equipment erected and installed by the Rudge-Whitworth, Ltd., adjacent to firm's ball-bearing works at Sparkhill, Birmingham. Describes new measuring instruments, including the millimike, measuring sizes within capacity of micrometer to within 0.00001 in.; the pyromike, an optical pyrometer for measuring all temperatures from red heat upwards; and oxyscope, for measuring effects of oxidizing and reducing furnace gases upon various metals.

LATHES

Automatic. The Herbert Auto-Lathe. Engr., vol. 131, no. 3413, May 27, 1921, pp. 574-575, 4 figs. Automatic lathe manufactured by Alfred Herbert, Coventry, England.

Precision Bench Lathes. Tools and Methods for Manufacturing Precision Bench Lathes. LL, Machy (Lond), vol 18, no 451, May 19, 1921, pp 201-207, 9 figs. Machining and inspection methods used in manufacture of T. I. M. bench lathe.

LIGNITE

Briquetting Plants. Modern Lignite Briquetting Plants (Einige neuzeitliche Braunkolen-Briketterzeugungsanlagen), R Schapira. Feuerungstechnik, vol 9, nos. 125-129, 19 figs. Briquet factories constructed by the Zeitz Iron Foundry and Machine Constr Corp. Germany.

LIME

A. S. T. M. Committee Report. Report of Committee C-7 on lime. Am. Soc. for Testing Matls., paper of annual meeting, June 21-24, 1921, 32 pp. 1 fig. Specifications for finishing hydrated lime. Comparative tests on effect of hydrated lime on concrete mixtures. Specifications for quick lime for structural purposes. Chemical analysis of limestone, lime and hydrated lime.

LOCOMOTIVES

Pressure on Rails. Note on the Determination of the Stresses at the Point of Contact Between the Tire of a Locomotive Wheel and the Head of the Rail, R. Desprets. Bul. Int. Ry. Assn., vol. 3, no. 5, May 1921, pp. 507-511, 2 figs. Formulas for calculating stresses.

LUBRICATING OILS

Air Compressors. Lubricating-Oils for Diesel-Engine Air-Compressors. Motorship, vol. 6, no. 6, June 1921, p. 474. Specifications regarding oils suitable for use for lubricating air compressors adopted by Diesel Engine Users Assn.

LUBRICATION

Marine Turbines. The Lubrication Problem on Shipboard, P. M. Robinson. Mar. Eng., vol. 26, no. 6, June 1921, pp. 458-462, 6 figs. Oiling system recommended by Westinghouse Elec. & Mfg. Co. for geared-turbine equipment.

M

MACHINE SHOPS

Automobile. Special Machines and Fixtures in the Franklin Plant. Machy. (Lond.) vol. 18, no. 451, May 19, 1921, pp. 193-199, 19 figs. Mechanical equipment designed either to increase production, perform special operations or maintain established standards of accuracy, in different departments of plant in Syracuse.

Design. A Monitor-Type Shop for Building Lathes, Fred H. Colvin. Am. Mach., vol. 54, no. 24, June 16, 1921, pp. 1030-1031, 6 figs. Monitor type of building with slanting sides and all roof drainage towards center of building.

MACHINE TOOLS

Oil-Grooving Machine. The Haigh Oil-Grooving Machine. Machy. (Lond.), vol. 18, no. 452, May 26, 1921, pp. 234-235, 3 figs. Machine recently developed for rapidly cutting external or internal oil grooves in shafts and bearings.

MALLEABLE CASTINGS

Motorcycles. From the Foundry to the Speedway, Herbert R. Simonds. Foundry, vol. 49, no. 12, June 15, 1921, pp. 459-462, 11 figs. Malleable parts used in motorcycles are brazed to steel tubing. Practice of Hendee Mfg. Co. Springfield Mass.

MALLEABLE IRON

Melting Furnaces. American Malleable Cast Iron—XII, H. A. Schwartz. Iron Trade Rev., vol. 68, no. 24,, June 16, 1921, pp. 1662-1668, 5 figs. Types of air furnaces for melting malleables iron.

MARINE BOILERS

Construction. Marine Boiler Construction, Machy (Lond), vol 18, no. 453 June 2, 1921, pp 265-271, 13 figs. Methods and machines employed in modern practice

Design. Standard Conditions for the Design and Construction of Marine Boilers. Steamship, vol 32, no 384, June 1921, pp 205-209. Conditions as to design workmanship, hydraulic test, etc., Regulations of British Board of Trade (Concluded.)

Oil-Burning. Oil-Fuel and Mixed-Fuel Burning in Marine Boilers. Shipbuilding & Shipping Rec., vol 17, no 23, June 9, 1921, pp 707-708. Methods of burning oil fuel. Practice in British navy. (To be continued.)

MARINE STEAM TURBINES

Assembling Methods. Turbine Work at the Puget Sound Navy Yard. Am Mach., vol 54, no 24, June 16, 1921, pp. 1014-1015, 7 figs. Methods of boring, blading and assembling ship turbines.

Testing. Report of Committee E-1 on Methods of Testing. Am Soc. for Testing Matls., paper of annual meeting, June 21-24, 1921, 8 pp. Developments of standard methods of testing metals, especially iron and steel.

MOLYBDENUM

Properties. Molybdenum, Arthur H. Hunter. Am. Iron & Steel Inst., advance paper, May 27, 1921, 20 pp.. Occurrences, manufacture, properties and uses.

MOLYBDENUM STEEL

Properties. Manufacture and Properties of Molybdenum Steels, Arthur H. Hunter. Iron Age, vol 107, no. 22, June 2, 1921, pp. 1469 & 1511-1512. Their adaptability to fabrics iron and their cost. Comparison with other alloy steels. Paper read before Am. Iron & Steel. Inst.

Uses. Molybdenum Steel and Its Application, H. M. Schmid. Trans,. Am. Soc. for Steel Treating, vol. 1, no. 9, June 1921, pp. 500-505. Also in Chem. & Metallurgical Eng., vol. 24, no. 21, May 25, 1921, pp. 927-929. Beneficial effect of little molybdenum on physical properties of complex alloys, especially allowing safe use or high working temperatures and wide range of quenching and annealing heats. Uses in automotive forgings and pressed heats. Uses in automotive forgings and pressed metal parts..

Molybdenum Structural Steels and Their Application, Martin H. Schmid. Iron Age, vol. 107, no 22, June 2, 1921, pp. 1444-1445. Open-hearth practice. Blooming and finish rolling characteristics. . Features in thermal manipulations. Paper read before Am. Soc. for Steel Treating.

MOTOR-TRUCK TRAFFIC

Developments. Recent Developments in Motor Truck Traffic (La Situation actuelle de la traction mécanique sur route), G. Malgorn. Vie technique & industrielle, vol. 2, no. 19, April 1921, pp. 13-18, 13 figs. Tractors and trailers. (Concluded).

Developments. Recent Developments in Motor Truck Traffic (La situation actuelle de la traction méchanique sur route), G. Malgorn. Vie technique & industrielle, vol. 2, no. 18. Mar. 1921, pp. 502-506, 11 figs. Types of motor trucks used for highway traffic. (Continuation of Serial.)

N

NICKEL

Properties. Nickel. U. S. Dept. of Commerce. Circular of Bur. of Standards, no. 100, Mar. 21, 1921, 106 pp. 26 figs. Properties, statistics of production, and metallurgy.

NICKEL PLATING

Solutions. The use of Fluorides in Solutions for Nickel Deposition, William Blum, Brass World, vol. 17, no. 5, May, 1921, pp. 121-127, 3 figs. Notes on experiments upon the operation of solutions carried out at Bur. of Standards.

NON-FERROUS METALS

A. S. T. M. Committee Report. Report of Committee B-2 on Non-Ferrous Metals and Alloys. Am. Soc. for Testing Matls., paper of annual meeting, June 21-24, 1921, 14 pp. Proposed tentative specifications, methods for chemical analysis nomenclature and methods of testing.

O

OIL FIELDS

Canada. Prospects of Oil at Peace River, Edmund M. Spieker. Min. & Eng. Rec., vol. 26, nos. 9 & 10, May 1921, pp. 116-122. Geological description of foothills of Rocky Mountains in British Columbia.

The possibilities of the Oil Resources of Canada, D. B. Dowling. Trans. Royal Can. Inst., vol. 13, part. 1, no. 29, Feb. 1921, pp. 39-47, 2 figs. Geological study.

Persian-Mesopotamian. The Persian -Mesopotamian Oilfield, Petroleum World, vol. 18, no. 249, June 1921, pp. 225-232, 6 figs. Geological notes.

OIL SHALES

Bibliography. Oil Shale Industry—Selected Bibliography, Victor C. Anderson. Quarterly of Colorado School of Mines, Vol. 16, no. 2, April 1921. pp. 27-38.

Distillation. Plant for Hot-Gas Pyrolytic Distillation of Shale, Louis Simpson. Petroleum Times, vol. 5, no. 122, May 7, 1921, pp. 521-523, 4 figs. Description and plan of a 2000-ton-per-day shale oil plant operating an indirect heating process employing hot gases for conveying reacting heat and resultant oil vapors from pyrolysis of the shale.

PEAT

Recovery. The Recovery and Fuel Value of Irish Peat. U. S. Dept. of Commerce, Commerce Reports, no. 121, May 25, 1921, pp. 1150-1151. Report of British Dept. of Scientific & Indus. Research. Irish bogs are estimated to cover about 3,000,000 acres.

P

PAINTS

Ass. T. M. Committee Report. Report of Committee D-1 on Preservative Coatings for Structural Materials. Am. Soc. for Testing Matls., advance paper of annual meeting, June 21-24, 1921, 38 pp. Proposed tentative specifications for oils and paints.

PAVEMENTS, BRICKS

Surface Treatment. Practical Limitations in "Surface Treatment" of Old Brick or Block Pavements, W. L. Hempelmann. Mun. & County Eng., vol. 40, no. 5, May 1921, pp. 181-182. Practices in cities in Southern U. S.

PETROLEUM

Nomenclature. British Petrographic Nomenclature. Min. Mag., vol. 24, no. 5, May 1921, pp. 278-281. Report of joint committee of Geological and Mineralogical Societies on Standardization of petrological terms.

Products. Report of Committee D-2 on Petroleum Products and Lubricants. Am. Soc. for Testing Matls., paper of annual meeting June 21-24, 1921, 76 pp. 12 figs. Proposed tentative methods of testing for distillation of gasoline, naphtha kerosene and similar products, for viscosity of fuels oils, for detection of sulphur and corrosive sulphur compounds in petroleum products in naphthas and illuminating oils, for open-cup flash and fire test and for cloud and pour points of petroleum products.

PILES

Effect in Clay. Lateral and Vertical Pressure Effect of Piles in Clay, Henry R. Lordly. Cornell Civil Engr., vol. 29, no. 8, May 1921, pp. 143-149, 13 figs. Tests demonstrate effects of various methods of grouping on resistance of piles. X-ray pictures determine displacement of clay by driven pile.

PIPE, CONCRETE

Testing. Device for Testing Sections of Concrete Pipe Eng. News. Rec., vol.86, no. 21, May 26, 1921, pp. 887, 1 fig. Device developed by California Assn. of Cement Pipe Manufacturers for making hydrostatic tests on single sections of concrete pipe without use of false ends and tie-rods.

Hume. Making Concrete Pipes by Centrifugal Force. So. African Jl. of Industries, vol. 4, no 3, Mar.-April 1921, pp. 224—235, 13 figs. Description of Hume process.

PIPE, STEEL

Centrifugal Casting. New Process for Automatic Making of Steel Tubing. Iron Age, vol. 107, no. 20, May 1, 1921, pp. 1300. Patented process for centrifugal casting of steel pipe. Process comprehends using electric melting of metal in conjunction with centrifugal casting and making of steel tubes, including those of alloy steels, such as are used for manufacturing ball-bearins graces.

PIPING

Layouts. Steam Pipe Sizes, Alfred Cotton. Power, vol. 53, no 21, May.24, 1921, pp. 832-836, 7 figs. Determination by pressure drop instead of velocity. Charts for 0 to 1,000,000 lb. of steam per hr. at pressures up to 300 lb. per sq. in.

PLANING

Production Systems. Production Planing in Machine Tool Plants. Machy. (N.Y) vol. 27, no. 10, June 1921, pp. 966-971, 6 figs. Practice at works of G. A. Gray Co. and of Cincinnati Planer Co.

Preduction planing in machine tool plants—Machy. (Lond.), vol. 18, nos. 449 and 452, May 5 and 26, 1921, pp. 129—134 11 figs. and 225-229, 4 figs. May 5: Practice of shops engaged in manufacture of drilling and boring machines and heavy lathes. May 26, Efficiency factors in production planing points to observe in obtaining maximum output from planers.

PNEUMATIC TOOLS

Heat Treatment. Heat Treatment of Thor Tool Parts, J. V. Hunter. Am. Mach. vol. 54, no. 23, June 9, 1921, pp. 991-996, 20 figs. Efficient methods of heat-treating pneumatic tool parts. Control system to check workmen.

PRESSURE VESSELS

Stresses. Calculating Stresses in Pressure Vessels, William C. Strott. Boiler Maker vol. 21, no. 6, June 1921, pp. 163-166, 4 figs. Strength of materials used in cylindrical tank construction and allowable external pressures on vacuum tanks. (Concluded.)

PROFIT SHARING

British Works. Profit Sharing in Practice. Eng. & Indus. Management, vol.5 no. 18, May 5, 1921. pp. 513-514. Scheme of profit sharing adopted at works of W. G. Armstrong, Whitworth & Co., Ltd., Rules of Employees' deposit fund in operation at these works.

PROTECTIVE COATINGS

Tests. The Protection of Iron with Paint Against Atmospheric Corrosion, J. Newton Friend. Iron & Steel Inst., annual meeting, May 5-6, 1921, advance paper no. 5, pp. 4. Experiments on value of several protective costings.

PULVERIZED COAL

Combustion. Effect of Preheat and Excess Air on Combustion of Fuel, A. D. Williams. Power, vol. 53, no. 24, June 14, 1921, pp. 960-962, 3 figs. Graphs showing characteristic combustion of pulverized coal.

Developments. Use of Powdered Fuel Under Steam Boilers, Harlow D. Savage. Am. & Iron Steel Inst., advance paper, May 27, 1921, 41 pp., 18 figs. Also in Iron Age, vol. 107, no. 22, June 2, 1921, pp. 1464-1467, 2 figs. Survey of developments in installation of equipment for burning pulverized coal in steam power plants. Tests and comparative costs. Paper read before Am. Iron & Steel Inst.

Tests. Present Status of Powdered Coal, Chas. Longenecker. Blast Furnace & Steel Plant, vol. 9, no. 6, June 1921, pp. 394-397, 1 fig. Tests illustrating results obtained in burning various grades of coal.

PUMPING

Costs. Record System of Steam and Motor Pumping Costs, O. A. Anderson. Power, vol. 53, no. 22, May 31, 1921, pp. 887-892. Tables showing quantities of water required for condensers of steam and refrigerating systems and amount of air per gallon of water in air-lift system.

PUMPS, CENTRIFUGAL

Efficiency. Centrifugal Pumps—II. Dependency of Efficiency upon Type, Size and Speed, W. D. Canan. Power, vol. 53, no. 20, May 17, 1921, pp. 780-782, 3 figs. Methods of Plotting curves.

Operation. Baltimore Pump Sets New Duty Record for Centrifugals. Eng. News-Rec., vol. 86, no. 22, June 2, 1921, pp. 938-939, 3 figs. Tests showed maximum duty of 1,720,250,000 ft. lb. per 1000 lb. of steam at 175 lb. gage pressure, 60 deg. fahr. superheat and water temperature of 70 deg. fahr.

Wilfley. The Wilfley Centrifugal Pump, John Goodman. Practical Engr., vol. 63, no. 1786, May. 19, 1921, pp. 311-313, 4 figs. Extracts from report on series of tests carried out on new type of centrifogal pump produced by Wilfley Co., Ltd., London, having impeller fitted with hollow trunnion through which suction water passes on its way to impeller passages.

PYROMETRY

British Practice. Reviews British Pyrometry Practice, Ernest J. Davis. Foundry, vol. 49, no. 12, June 15, 1921, pp. 463-467, 5 figs.

R

RAILS

Acid Bessemer. Bessemer Acid Steel Rails, Cecil J. Allen. Ry. Engr., vol. 42, no. 496, May 1921, pp. 182-184. Records of Tests.

Failures. Punishment of Rails, James E. Howard. Iron Age, vol. 107, no. 21, May 26, 1921, pp. 1375-1376, 3 figs. Report to Intersate Commerce Commission on failure of 75-ton Bessemer steel rail. Attention is drawn to difference, both in original and in effect,of rail hardness produced by cold-rolling action of wheels and by their slipping.

RAILWAYS

Valuation. Railway Valuation in Connecticut—I, Archer E. Knowlton. Elec. Ry. Jl., vol. 57, no. 21, May 21, 1921, pp. 947-950, 3 figs. Procedure in assigning value to "inside plant" property of $50,000,000 railway system.

RAILWAY ELECTRIFICATION

India. The Electrification of Indian Railways. Ry. Engr., vol. 42, nos. 496-497, May and June 1921, pp. 185-188, and 1 fig., and 218-222, 14 figs. Advantage of using electric locomotives as compared with steam locomotives in heavily graded sections of North Western Ry. of India.

Switzerland. Electrification of St. Gotthard Line Switzerland, Hans W. Schuler. Ry. Elec. Engr., vol. 12, no. 6, June 1921, pp. 221-227, 15 figs. Electrified section is 101 miles long and has average grade of 2.6 per cent for 30 miles. Single-phase, 15,000-volt power is used.

The Electrification of the Swiss Railways, Engr., vol. 131, no. 3413, May 27, 1921, pp. 563-564. Survep of Developments.

RAILWAY MOTOR CARS

Gasoline Driven. Gasoline Driven Motor Omnibus for Railroads. Ry. Age, vol. 70, no. 23, June 10, 1921, pp. 1363-1364, 2 figs. Two car units consisting of motor car and trailer for passenger service on branch lines.

RAILWAY OPERATION

Train Dispatching. New Record Demonstration of Heavy Tonnage Train Handling. Ry. & Locomotive Eng. vol. 34, no. 6, June 1921, pp. 151-155, 7 figs. Experience of Virginian railway in handling trains of 16,000 gross tons on heavy grades in regular train service.

RAILWAY REPAIR SHOPS

Welding. Shop Notes from Buffalo Elec. Ry. Jl., vol 57, no. 25, June 18, 1921, pp. 1114-1118, 14 figs Reclamation of material and welding methods at railway repair shop of Int. Ry. Buffalo.

RAILWAY SHOPS

Mechanical Equipment. Revivifying the Railroad Shop, G W. Armstrong. Ry. Mech. Engr., vol. 95, no 6, June 1921, pp. 341-345, 8 figs. Notes on installation of mechanical equipment.

RAILWAY SIGNALING

England. Three-Position Signaling in Great Britain Ry. Signal Engr., vol. 14, no. 6, June 1921, pp. 211-218, 10 figs. First Installation of this type in England made on Great Western. A. C. Apparatus fog repeators and automatic stops used.

RAILWAYS

Short Line Roads. The Traosportation Problem and the Short Line Roads. Ry. Rev., vol. 68, no. 23, June 4, 1921, pp. 860-862. Extracts from report of president of American Short Line Railroad Assn.

REAMERS

Standards. Report of the German Industries Committee on Standards (Mitteilungen des Normennausschusses der Deutschen Industrie), Betrieb, vol. 3, no. 16, May 10, 1921, pp. 227-239, 19 figs. Proposals of Board of Directors for hand and machine reamers (solid adjustable and shell), and pilot shanks.

REDUCTION GEARS

Design. Mechanical Reduction Gears on Warships and Merchant Ships, John H. Macalpine. Engineering, vol. 111, nos. 2890 and 2891, May 20 and 27, 1921, pp. 609-611, and 640-642, 2 figs. Graphs indicating tooth pressure per inch of face. Arguments against introducing fly wheel just aft of gear.

REFRACTORIES

Oil-Fired Furnaces. Refractories for Oil-Fired Furnaces and Boilers, W. H. Grant. Jl. Am. Ceramic Soc. Soc. vol. 4. no. 5, May 1921, pp. 390-392. Causes of failure of firebrick in oil-fired furnaces.

REFRIGERATING MACHINES

Specifications. Specifications for Refrigerating apparatus, G. H. Crawford. Power vol. 53, no. 21, May 24, 1921, pp. 854-856. Points that should be covered in specifications.

REFRIGERATING PLANTS

Steam Engines. Steam Engines for Refrigerating Plants, W. H. Motz. Power, vol. 53, no. 23, June 7, 1921, pp. 916-919, 6 figs. Selection and efficient operation of steam engines for driving ice-making and refrigeration plants. Graphs showing comparative performances of various steam engines.

Wall Insulation. Insulstion of Concrete Walls, Nolan D. Mitchell Concrete Age, vol. 34, no. 2, May 1921, pp. 15-17. Tables giving heat conductivity of common wall materials.

Welded Ammonia Containers. Some Tests on Wedded Ammonia Containers, E. A. Fessenden. A. S.R.E. Jl., vol. 7, no. 4, Jan. 1921, pp. 281-305, 31 figs. Results of tests made to compare different methods of constructing cylinders for handling anhydrous ammonia in refrigerating plant practice.

RESEARCH

Industrial. Governmental Research, George K. Burgess. Trans. Royal Can. Instn., vol. 13, part 1, no. 29, Feb. 1921, pp. 121-132. Discusses organization of industrial research under auspices of government.

University of Illinois. The Functions of the Engineering Experiment Station of the University of Illinois, Charles Russ Richards. University of Ill. Bul., vol. 18, no. 24, Feb. 14, 1921, 21 pp.

ROAD CONSTRUCTION

Arizona. Arizona County Undertakes 309-Mile Paved Road System, Ralph Rollins. Eng. News-Rec., vol. 86, no. 21, May 26, 1921, pp. 882-885, 7 figs. Special concrete slab section and construction methods devised for hot dry climate. System brings every farm within one mile of concrete road

A.S.T.M. Committee Report. Report of Committee D-4 on Road and Paving Materials. Am. Soc. for Testing Matls., advance paper of annual meeting. June 21-24, 1921, 23 pp. 2 figs. Proposed tentative specifications for asphalt cement, tar cement, coal tar pitch, etc.

Legislation. Current Highway Legislation—VII. Good Roads, vol. 21, no. 19, May 11, 1921, pp. 255-256. Revised Townsend bill introduced in Congress. Several states pass engineer licensing laws. Pennsylvania increases motor vehicle fees.

Machinery. Road Building and the Mechanical Engineer, B. H. Piepmeier, R. C. Marshall, Jr. and C. D. Curtis. Mech. Engr., vol. 43, no. 6, June 1921, pp. 386-390, 5 figs. Problems in relation to road building machinery presented under auspices of Materials Handling Division at Am. Soc. Mech. Engrs. spring meeting. Tiles of papers were: Road-Construction Plants; Mechanical Needs in Highway-Construction Machinery; and Planning and Organizing a Road Job for Mechanical Handling of Material.

ROADS, CONCRETE

Reinforced. New Design for Illinois Concrete Highways, Eng. World, vol. 18, no. 6 June 1921, pp. 421-422, 3 figs. Corrugated longitudinal center joint. Bars tie adjacent sections and resist shear.

ROCK DRILLS

Magnetic Analysis. Application of Magnetic Analysis to Rock Drills, Charles W. Burrows, Min. & Metallurgy, no. 174, June 1921, pp. 42-43, 1 fig. Experience in use of magnetic defectoscope. (Abstract.)

Steel. What is the Ideal Drill Steel?—Frank H. Kingdon. Min. & Metallurgy, no.174, June 1921, pp. 47 and 50-51, 1 fig. Answers to questionnaire showed that double arc, double -taper bit and cross-bit give best service.

Tests. Analysis of Some Drill-Steel Tests, Francis B. Foley. Min. & Metallurgy, no. 174, June 1921. pp. 43 and 46-47, 1 fig. Tests on breakage of shank and bit end. Breakage is attributed to faulty practice in forging and hardening. (Abstract.)

ROLLING MILLS

Cost of Rolling Steel. Review of Cost of Rolling Steel in Various Mills, G. E. Stoltz. Assn. Iron & Steel Elec. Engrs., vol. 3, no. 5, May 1921, pp. 99-115 and (discussion) pp. 116-154, 2 figs, 1 on suppl. plate. Outlines method of reducing cost of producing steel . Includes tables of power and main drive operating cost of rolling steel, and chart showing comparison of cost of rolling steel on electric and steam-driven reversing blooming mills.

ROPE DRIVE

Belting vs. Manila Rope and the Engineer, Rupert E. Shotts and Harry E. Wade. Eng. World, vol. 18, no. 6 June 1921, pp. 405-409. 4 figs. Graph giving relative cost per foot of drive for rope and belting using most efficient speeds in each case

Wire Rope. Power Transmission by Wire Rope, L. J. Dixon. Power, vol. 53, no. 22, May 31, 1921, pp. 893-896, 8 figs. Application and arrangement of system type and size of sheaves. Rope construction, driving tension, velocities and horsepower transmitted. Idle sheaves and take up devices.

RUBBER

Synthetic. Synthetic Rubber (Les caoutchoucs factices), A. Neef. Revue Universelle des Mines, vol. 9, no. 3, May 1, 1921, pp. 242-252. Survey of development in manufacture of synthetic rubber.

S

SCIENTIFIC MANAGEMENT

See Industrial Management.

SCREW THREADS

Standardization. Committee for Standardization of Screw Threads (Commission pour l'unification des filetages). Bulletin de la Société d'Encouragement pour l'Industrie nationale, vol. 133, no. 4, April 1921, pp. 380-383, 1 fig. Table giving standard dimensions of bolts and screws of iron 2. 5-mm to 12.-mm diameter. Adopted by Committee of Union of Electrical Syndicates in France.

SEWAGE

Sludge. The Role of Acidity in the Dehydration of Sewage Sludge, John Arthur Wilson and Henry Mills Heisig. Jl Indus. & Eng. Chemistry, vol. 13, no. 5, May 1921, pp. 406-410, 4 figs. Experimental study at sewerage testing station of Milwaukee, Wis.

SHIP PROPULSION

Jet propulsion. The Effective Propulsion of Craft for use on Shallow and Obstructed Waterways, J. H. Gill. Trans. Inst. Mar. Engrs., session 1921-22 vol. 33, Apr. 1921, pp. 57-74, 14 figs. Discussion of jet propulsion.

SHIPPING

Containers. Report of Committee D-10 on Shipping Containers. Am. Soc. for Testing Matls., advance paper of annual meeting. June 21-24, 1921, 8 pp. 3 figs. Proposed tentative general specifications for 4-one boxes and similar type boxes.

SHIP PROPULSION, ELECTRIC

U. S. S. Tennessee. Electric Drive and the U. S. S. Tennessee, H. M. Southgate. Elec. Jl., vol. 18, no. 6, June 1921, pp. 239-289, 70 figs. Series of articles describing propelling machinery of U. S. S. Tennessee.

SHOVELS

Electric. Electric Shovel Load Characteristics, D. Stoetzel. Gen. Elec. Rev., vol. 24, no. 6, June 1921, pp. 546-549, 4 figs. Graphs of kilowatt imput.

SOOT BLOWERS

Tests. Some Results with Mechanical Soot Blowers. Robert June. Power House, vol. 14, no. 7, April 5, 1921, pp. 21-24. Survey of recent tests with coal, pulverized fuel and oil.

SPRINGS

Formulas for Design. Formulas for Spring Design. Machy. (Lond.) vol. 18, no. 451, May 19, 1921, pp. 209-211, 4 figs. Formulas used by draftsmen and designers of Briggs Stratton Co., Milwaukee.

SPROCKET CHAINS

Standardization. Proposed Standard Roller-Chain Sprocket. Am. Mach., vol. 54, no. 24, June 16, 1921, pp. 1052-1053, 2 figs. Except from report of Chain Division of Standards Committee of Soc. of automotive Engrs. at West Baden, Ind., May 24, 1921.

STACKS

Corrosion. Surrounding Corroded Steel Stacks with Concrete, John V. Schaefer. Power Plant Eng., vol. 25. no. 11, June 1, 1921, pp. 560-561, 2 figs. Experience at South Works, Illinois Steel co., South Chicago.

STAMPING

Methods. Producing a Stamped Shift Lever Dome. N. T. Thurston. Iron Age. vol. 107, no. 22, June 2, 1921, pp. 1441-1444, 11 figs. Dies and method of production.

STEAM

Entropy. Entropy of Steam, M. J. Eichhorn. Power vol. 53, no. 24, June 14, 1921 pp. 966-967, 1 fig. Nomogram for entropy of steam.

High-Pressure. The Properties of High Pressure Steam, M. J. Eichhorn. Power, vol. 53, no. 20, May 17, 1921, pp. 782-783, 1 fig. Nomogram for properties of steam up to critical point.

Superheated. *See Superheated Steam.*

STEAM ENGINES

See also Refrigeration Plants, Steam Engines.

Glasgow. The Dalmarnock Power Station. Engineering, vol. 111, nos. 2891 and 2893, May 27 and June 10, 1921, pp. 635-639 and 650, 38 figs. partly on 4 supp. plates, and 703-707, 21 figs. Glasgow steam-electric plant designed for ultimate capacity of 200,000 kw. Details of 16,000 kw. three-phase generators.

STEAM POWER PLANTS

Central Heating Stations. Modern Tendencies in the Construction of Central Plants (Les tendances modernes dans la construction des centrales) F. Scoumanne. Revue universelle des Mines, vol. 9, no. 3 May 1, 1921, pp. 229-241, 2 figs. Central heating stations. (To be continued.)

Operation. Efficient Operation of Oil Burning Steam Plants, C. H. Delany. Power Plant Eng., vol. 25, no. 11, June 1, 1921, pp. 551-556, 7 figs. Method of establishing standards of efficiency at various loads. Paper read before San Francisco Section, Am. Soc. Mech. Engrs.

STEAM TURBINES

Developments. Recent Improvements in Steam Turbine Design. Engr., Vol. 131, nos. 3410, 3412 and 3413, May 6, 20 and 27, 1921, pp. 482-484, 5 figs., 531-539, 10 figs., and 502-503, 6 figs. May 6. Marine-type geared turbo-generator manufactured by W. H. Allen, Sons & Co., Bedford, England. May 20. Types recently manufactured by Brown, Boveri & Co., May 27. Types built by English Electric Co.

Shaft Glands. Steam-Turbines Shaft Glands, John R. Baker. Power, vol. 53, no. 22, May 31, 1921, pp. 881-883, 6 figs. Methods of packing.

STEEL

A. S. T. M. Committee Report. Report of Committee A-1 on Steel. Am. Soc. for Testing Matls., paper of annual meeting, June 21-24, 1921, 42 pp. 1 fig. Proposed revisions in standards and tentative standards for steel, welded and seamless steel pipe, carbon steel, welded and seamless pipe, carbon steel rails, cold drawn steel wire for concrete reinforcement, and boiler tubes.

Alloy. *See Alloy Steels.*

Impact Testing. Impact Testing of Notched Bars (Essais de choc sur barreaux entaillés), M. Legrand. Revue de Métallurgie, vol. 18, no. 4, April 1921, pp. 225-228, 1 fig. Tests conducted by French Permanent Commission. Bars tested were of Martin steel.

Internal-Combustion Engine Valves. Steel for Internal-Combustion Motor Valve, G. Gabriel. Automotive Manufacturer, vol. 42, no. 2, May 1921, pp. 19-22. Minimum requrements as determined in use of light weight and airplane engines. Effect of high temperatures on various steel. Metallurgical viewpoints. Translated from La Technique Automobile et Aérienne. (To be continued.)

Marine Engineering. Steel, from the Standpoint of Marine Engineering, W. H. Hatfield. Jl. West of Scotland Iron & Steel Inst., vol. 28, part 5, session 1920-1921, Feb., 1921, pp. 52-72 and (dicussion) pp. 72-78, 17 figs. on supp. plates. Writer concludes that (1) it is desirable to use, wherever possible, ship plates and sections of increased mechanical strength; (2) it is advisable to extend use of some special steels now available for power unit and transmission parts; and (3) it is desirable to increase use of other special steels available for resisting rust and where needed, high temperatures.

Mechanical Properties. Calculation of Mechanical Properties of Steel from its Chemical Composition, Hugh O'Neill. Iron & Coal Trades Rev., vol. 102, no. 2777, May 20, 1921, p. 709. Formula is developed.

Metallography. Report of Committee E-4 on Metallography. Am. Soc. for Testing Matls., paper of annual meeting, June 21-24, 1921, 16 pp. Proposed tentative methods of metallographic testing on iron and steel.

Molybdenum. *See Molybdenum Steel.*

Quenching Cracks. On the cause of Quenching Cracks, Kôtarö Honda, Tokujrô Matsushita and Sakaé Idel. Iron & Steel Inst., annual meeting, May 5-6, 1921, advance paper no. 6, 16 pp. 9 figs. It is concluded from tests that in quenched steel certain amount of austenite is generally present intermingled in martensite. Amount of austenite increases as quenching temperature increases. Quenching cracks occur when hardness in central portion is much greater than in periphery.

Specifications. French Specifications for Carbon Steels. Iron Age, vol. 107, no. 21, May 26, 1921, pp. 1372-1374. Full details for bars, blooms, billets and slabs of other than tool steels. Static, structure and shock, as well as welding tests, required.

Stainless. Stainless Steel, its Composition and Properties, Elwood Haynes. Iron Age, vol. 107, no. 22, June 2, 1921, pp. 1467-1469. Manufacture and uses. Influence of temperature. Limits of chromium content. Paper read before Am. Iron & Steel Inst.

Sulphur Determination. Comparison of different Methods of Estimating Sulphur in Steel, T. E. Rooney. Iron & Steel Inst., annual meeting, May 5-6, 1921, advance paper no. 9, 13 pp. Experiments with carbon and nickel-chromium steels.

Tests. Comparative Tests of Steels at High Temperatures, R. S. MacPherran. Am. Soc. for Testing Matls., paper of annual meeting, June 21-24, 1921, 9 pp. 6 figs. Tests made to determine comparative properties of various steels at high temperatures under operating conditions at temperatures between 600 to 1000 deg. fahr.

STEEL CASTINGS

Centrifugal. Testing Centrifugally Cast Steel, George K. Burgess. Iron Trade Rev., vol. 68, no. 21, May 26, 1921, pp. 1443-1447, 15 figs. Examination of several cylinders of various wall thickness and composition showed little segregation of elements and few blow holes. Physical properties of specimens were improved materially by heat treatment.

Manufacture. Checking Troubles in Steel Castings, R. B. Farquhar, Jr. Foundry vol. 49, no. 12, June 15, 1921, pp. 475-483, 23 figs. Notes on proper pouring, gating and feeding. Paper read before Am. Foundrymen's Assn.

STEEL, HEAT TREATMENT OF

Drill steel. Heat Treatment of Rock-Drill Steel, George H. Gilman. Min. & Metallurgy, no. 174, June 1921, pp. 35 and 38-39 and 42, 1 fig. Suggestions in regard to heat treating practice. (Abstract.)

Methods. Carburizing, Hardening and Tempering High Carbon Alloy Steels in 130 Minutes, R. L. Gilman. Trans. Am. Soc. for Steel Treating, vol. 1, no. 8, May 1921, pp. 445-448. Method is suggested.

Tool Steel. The Prevention of Hardening Crack and the Effect of Controlling Recalescence in a Tungsteen Tool Steel, Shipley N. Brayshaw. Iron & Steel Inst., annual meeting, May 5-6, 1921, advance paper no. 1, 86 pp. 26 figs. Research carried out on tool steel containing about 1.1 per cent of carbon and 0.8 to 0.9 per cent of tungsteen. Changes that occur during halts in heating and cooling were investigated in number of bars which, after soaking for various periods of time at temperatures near critical points, were quenched in water. Results suggested that, both in heating and in cooling, changes Ac1. 2.3 and Ar 3.2.1 take place in stages which may be separated one from another if sufficient time is allowed for process.

STEEL, HIGH SPEED

Hardness. Relation of the High Temperature Treatment of High Speed Steel to Sedondary Hardening and Red Hardness, Howard Scott. Trans. Am. Soc. for Steel Treating, vol. 1, no. 9, June 1921, pp. 511-526, 18 figs. Based on study of microstructure, hardness, density, magnetic properties and thermal characteristics of a typical high speed steel.

Electric Furnace. Electric Furnaces for Making Steel—IV, Alfred Stansfield. Blast Furnace & Steel Plant, vol. 9, no. 6, June 1921, pp. 381-385, 6 figs. General features and advantages of Ludlum furnace and of Vom Baur furnace. Classification of electric steel-making franaces.

Pig Casting Machine. Pig Casting Machine and Iron Storage. Iron Age, vol. 107, no. 21, May 26, 1921, pp. 1381-1385, 2 figs. Equipment at Hamilton works of Steel Co. of Canada includes quenching pit and station for transferring iron between ladles.

STEEL WORKS

Power Plants. Modern Steel Works Power Plants, Walter N. Flanagan. Iron Age, vol. 107, no. 23, June 9, 1921, pp. 1555-1559, 4 figs. Centralization and economy of units stresses. Attention to details urged as source of savings. Paper presented before Am. Iron & Steel Inst.

STOKERS

Chain-Grate. Recording Ash-Pit Loss from Chain Grate Stokers, E. G. Bailey. Mech. Eng., vol. 43, no. 6, June 1921, pp. 381-385, 12 figs. Recording device consist of thermometer bulb filled with nitrogen and connected through capilary tube to mercury U-tube, one leg of which is open to atmosphere and carries a float to which recorder pen is attached.

Draft Resistance. Draft Resistance of Underfeed Stokers, Alfred Cotton. Power, vol. 53, no. 22, May 31, 1921, pp. 874-875, 3 figs. Graphs constructed from results obtained in experiments.

STREETS

Width. Widths of Roadways and Sidewalks in Municipalities, H. J. Fixmer. Eng. & Contracting, vol. 55, no. 22, June 1, 1921, pp. 540-542. Report on relation of roadway width to width and speed of vehicle submitted to Nat. Highway Traffic Assn.

SUBSTATIONS

Industrial Plants. Industrial Plants Substations, E. G. Merrick and B. Nikiforoff. Gen. Elec. Rev., vol. 24, no. 6, June 1921, pp. 497-500, 12 figs. Typical substation arrangements.

SUPERHEATED STEAM

Specific Heat. Specific Heat of Superheated Steam, M. T. Eichhorn. Power, vol. 53, no. 22, May 31, 1921, pp. 892, 1 fig. Nomograms of properties of superheated steam.

SWAGING

Cold Swaging. Cold Swaging—1, Fred R. Daniels. Machy (N.Y.), vol. 27, no. 10, June 1921, pp. 930-934, 8 figs. Also in Machy. (Lond.) June 2, 1921, pp. 257. Application of swaging process and its effect on quality of metal. Study based on experience of Torrington Co., Torrington, Conn.

TABULATING MACHINES

Census Tabulating. Census Tabulating Machine. Engr., vol. 131, no. 3412, May 20, 1921, pp. 532-533 and 535, 3 figs. Hollerith patented machine.

T

TELEGRAPHY

Carrier Current. Carrier Current Telephony and Telegraphy, E. H. Colpitts and O. B. Blackwell. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 6, June 1921, pp. 517-526, 17 figs. Commercial apparatus installations. (Concluded.)

TERMINALS, RAILWAY

Chicago. Proposed Improvement of Chicago Railway Terminals. Eng. News Rec., vol. 86, no. 20, May 19, 1921, pp. 845-847, 2 figs. Report of Chicago Railway Terminal Commission.

TERMINALS, LOCOMOTIVE

Design. The Roundhouse Up to Date, Harold C. Prentice. Ry. Mech. Engr., vol. 95, no. 6, June 1921, pp. 337-340, 4 figs. Survey of developments in design of locomotive terminals.

TESTING MACHINES

Brinell. Brinell Testing Machine for Large Forgings. Engineering, vol. 111, no. 2892, June 3, 1921, pp. 680, 4 figs. Machines constructed for testing large forgings by W. & T. Avery, Birmingham, England.

Torsion-Bending. Alternating Stress Testing Machine. Engr., vol. 131, no. 3412, May 20, 1921, pp. 550, 2 figs. Slow-speed machines giving 200 cycles of combined bending and torsion per minute.

TIME STUDY

Method. Making Time Studies Pay, B. M. Maynard. Factory, vol. 26, no. 10, May 15, 1921, pp. 1178-1183, 7 figs. Principles illustrating by specific examples.

Training. Training Toward True Time Standards, C. B. Tyson. Factory vol. 26, no. 12, June 15, 1921, pp. 1402-1406, 5 figs. Course study developed at New York Shuipbuilding Corporation plant.

TOOLS

Press. The Design and Construction of Press Tools—IX. Eng. Production, vol. 2, no. 36, June 9, 1921, pp. 691-693, 4 figs. Drawing dies for cartridge cases.

TRANSFORMERS

Oil. Two Rapid Methods for Dtermining the Density of Transformer Oils (Deux methodes rapides pour la determination de la densité des huiles de transformateurs), O. Steels. Revue générale de l'Électricité, vol. 9, no. 21, May 21, 1921, pp. 715, 1 fig. Simplification of laboratory methods.

TUBES

Seamless Manufacture. Making Seamless Steel Tubes. Eng. Production, vol. 2, no. 35, June 2, 1921, pp. 675-679, 13 figs. Description of process involved.

TURBO-GENERATORS

Ventilation. Practice in Use of Electrical Apparatus. Elec. World, vol. 77, no. 23, June 4, 1921, pp. 1314-1316, Cosed-circuit system of ventilating turbo-generators coming into favor. Tendency toward greater use of electrically driven auxiliaries. Data on oil-circuit-breaker performance. Committee report presented at conference of Nat. Elec. Light Assn.

TURBULENCE

Research. Turbulence, H. C. Horning. Jl. Soc. Automotive Engrs., vol. 8, no. 6, June 1921, pp. 579-587, 13 figs. Collection of notes gathered from investigation of subject in literature of developments on internal-combustion engines and memoranda set down during long series of tests, also discussion of physical and chemical aspects of turbulence and methods of measuring it together with theory explaining it.

W

WASTE RECLAMATION

Railway Shops. Saving Materials in Railroad Shops, Frank A. Stanley. Am. Mach., vol. 54, no. 22, June 2, 1921, pp. 943-944, 7 figs. Methods of recovering lining metal from worn car journal bearings, also old bolts and air hose.

See also Bonus System.

Railways. Reclamation a By-Product of the Railway Business, R. K. Graham. Ry. Rev., vol. 68, no.23,June 4, 1921, pp. 843-848, 10 figs. Origin and development of centralized reclamation on Atchison Topeka & Santa Fe Ry.

WATER FILTRATION

Alum Coagulation. Coalugation of Water with Alum by Prolonged Agitation Wilfred F. Langelier. Eng. News-Rec., vol. 86, no. 22, June 2, 1921, pp. 924-928, 5 figs. Qualitative data obtained by experiment leads to redesign of coagulating methods for Sacramento filters. Contrary to widely held theories prolonged agitation is highly desirable.

WATER POWER

California. The Narshall Pan for Utilizing California's Waters. Eng. News-Rec., vol. 86, no. 23, June 9, 1921, pp. 994-996. Program for utilizing in California valley all important streams of state for irrigation, power and domestic uses.

Canada. Relation of Water Power to the Fuel Problem. Can. Engr., vol. 40, no. 21, May 26, 1921, pp. 503-506,and 510, 4 figs. Per capita coal consumption in Canada 50 per cent less than in U.S. and water power development 194 per cent greater. Developments reduce annual coal bill $146,500,000.

Legislation in United States. Analysis of the Water Power Act, Henry King Love. Water Power, vol. 3, no. 4, May 1921, pp. 11-14. How it proposes to protect consumers and reward investors and developers. Government Financing, it is claimed, would be desirable and proper to effect speedy utilization of waste.

WELDING

Preheating. Preheating Practice, David Baxter. Acetylene Jl., vol. 22, no. 12, June 1921, pp. 655-658, 5 figs. Preheating said to be a fundamental to successful welding procedure. Several examples are given.

Steel. The Welding of steel in Relation to the Occurrence of Pipe, Blowholes, and Segregates in Ingots, H, Brearley, Iron & Steel Inst., annual meeting, May 5-6, 1921, advance paper no. 2, 17 pp. 12 figs. Microscopical examinations.

See also Electric Welding; Electric Welding Arc; Electric Welding, Resistance.

WELDS

Testing. Standards for Testing Welds. Welding Engr., vol. 6, no. 5, May 1921, pp. 28-29, 32, 34 and 36, 14 figs. Also in Acetylene Jl., June 1921, pp. 661, and Ry. Elec. Engr., June 1921, pp. 237. Report to the Bur. of Welding, of Committee on Standard Tests for Welds. Specifications are inteaded primarily to serve as a standard, uniform basis testing and comparing sample welds as distinguished from welds in structures.

WELFARE WORK

Insurance of Employees. Autonomous Insurance Institutions for Benefit of Employees (Les institutions des prévoyances autonomes en faveur des employés), Emile Trasenster. Revue Universelle des Mines, vol. 9, no. 3, May 1, 1921, pp. 189-218, 11 figs. Financial study of their organization.

WOOD

A. S. T. M. Committee Report. Report of Committee D-7 on Timber. Am. Soc. for Testing Matls, paper of annual meeting, June 21-24, 1921, 8 pp. Recommendations with reference to revisions in specifications and progress of sub-committees.

WROUGHT IRON

A. S. T. M. Committee Report. Report of Committee A-2 on Wrought Iron. Am. Soc. for Testing Matls., paper of annual meeting, June 21-24, 1921, 23 pp. Proposed tentative specifications for wrought iron for various purposes.

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A

ACCIDENT PREVENTION

Building Construction. Prevention of Accidents in the Erection of Steelwork Contract Rec., vol. 35, no. 25, June 22, 1921, pp. 605-608. Instructions issued by construction firm to its foremen engaged in 'placing of structural steel. Rules governing handling of erection equipment and tools.

AEROPLANES ENGINES

Developments. The Requirements of Aeronautic Powerplant Development, G. J. Mead and L. E. Pierce. Jl. Soc. of Automotive Engrs., vol. 9, no. 1, July 1921, pp. 23-32, 2 figs. Review of developments of various engine types, analysis of effect of their characteristics on 'aeroplane performance and consideration of proper installation of powerplants in aeroplane.

French. French Aeroplane Engines in 1920 (Les moteurs d'aviation français en 1920), M. Martinot-Lagarde. Aéronautique, vol. 3, nos. 19-20, Jan. 1921, pp. 296-305, 11 figs. Panhard-Levassor, Schneider, Renault, Samson, Bréquet, Henri-Paul and Rhône.

Supercharging. An Analysis of the Effect of Supercharging. U.S. War Dept., Air Service Information Circular, vol. 2, no. 195, April 15, 1921, 11 pp. 8 figs. Analysis of typical performance of aeroplane fitted with supercharging device.

AEROPLANES

Corrosion of metal parts. Methods of Preventing the corrosion of Metal Parts of Aeroplanes. Aerial Age, vol. 13, no. 16, June 27, 1921, pp. 369-370, 1 fig. Graph giving results of comparative experiments on lasting qualities of various protecting methods. Air Service Information Circular.

Design. The Loads and Stresses in Aeroplanes, John Case. Aeronautics, vol. 20, no. 402, June 30, 1921, pp. 475-477, 6 figs. Model experiments with elevators of different sizes. (Continuation of serial.)

French Commercial Types. New French Commercial Airplanes. Aviation, vol, 11, no. 2, July 11, 1921, pp. 48. Spad 33 6-Seater and Potez-IX 5-Seater.

Performance. Airplane Performance and Design Charts, L. V. Kerber. Aviation, vol. 10, nos. 24 and 25, June 13, and 20, 1921, pp. 748-751, 2 figs. and 780-784, 15 figs.,June 13. Graphical solution of empirical-theoretical method of predicting performance of aeroplane of which are known weight, area, horsepower and external characteristics; also method for determining weight and area of aeroplane of given horsepower and external characteristics which is to be designed to realize a required performance. June 20: Charts for computing rate and time of climb for aeroplanes fitted with Liberty 12, Hispano-Suiza and similar engines.

AIR LIFT

Raising Liquids. Compressed-Air Lifts for Raising Liquids, A. T. Cross Mech. World, vol. 69, no. 1798, June 17, 1921, pp. 462-463, 3 figs Formulas and graphs for computing efficiency of installation.

AIRSHIPS

R38. H. M. Airship R38. Engr., vol. 131, no. 3415, June 10, 1921, pp. 610-611 and 620, 5 figs. Characteristics: Lenght, 695 ft.; diameter, 85 ft. 4 in.; capacity 2,700,000 cu. ft.; total normal lift, 83 tons; disposable lift, 50 tons; endurance at full speed 5000 mi.; estimated ceiling, 25,000 ft.

ALCOHOL ENGINES

Tests. Tests with Alcohol Engines (Undersökningar à Spritmotorer) , E. Hubendick. Teknisk Tidskrift (Mekanik), vol. 51, nos. 2, 3 and 4, Feb. 9, Mar. 9, and Apr. 13, 1021, pp. 25-31, 45-52 and 69-74, 23 figs. Comparison of efficiency and weight of engines for alcohol and for gasoline with same dimensions and same power. Basic principles of design. Results of tests show degree of compression to be from 7 to 9 for alcohol alone or mixed with gasoline or benzol. In spite of high degree of compression, output remains practically unchanged. Alcohol engines with flywheel are 20 per cent heavier than gasoline engines and 15 per cent. dearer Denaturing of alcohol.

ALLOY STEELS

Tests. Comparative Tests of Steels at High Temperatures, R. S. MacPherran. Chem. & Metallurgical Eng., vol. 24, no. 26, June 29, 1921, pp. 1153-1155, 13 figs. Determination of comparative properties of various alloy steels at high temperatures with a view to obtaining information as to best material for use under operating conditions of 600 to 1000 deg. fahr. It was found that introduction of metals forming carbides tends to strenghten steels at high temperatures. Paper read before Am. Soc. for Testing Matls.

ALLOYS

Microstructure. Micrographic Study of Alloys and of the Structure of Tungsten Steels by Their Slow Cooling (L'emploi des refroidissements très lents pour l'étude micrographique des alliages et la structure des aciers au tungstène), A. Portevin. Comptes rendus des séances de l'Académie des Sciences, vol. 172, no. 61, April 18, 1921, pp. 964-967, 2 figs. Record of experiments.

See also Bearing Metals; Copper Alloys; Iron Alloys; Monel Metal; Non-Ferrous Metal.

ALUMINUM ALLOYS

Melting Losses. Aluminum-Alloy Melting Loss Great, Robert J. Anderson. Foundry, vol. 49, no. 13, July 1, 1921, pp. 520-522. Description and estimation given of losses sustained in melting aluminum and aluminum alloys. Oxidation and heavy fuel consumption due to inefficient furnace operation principal causes. Report prepared for United States Bureau of Mines.

Reverberatory Furnaces. Aluminum and Its Alloys in Engineering—V, John G. A. Rhodin. Engr., vol. 131, no. 3414, June 3, 1921, pp. 586-589, 4 figs. Description of aluminum in reverberatory furnaces.

Uses. Aluminum and Its Alloys in Engineering, John G. A. Rhodin. Engr., vol. 131, nos 3415 and 3416, June 10 and 17, 1921, pp. 622-623 and 635-636, June 10: Behavior of aluminum castings. June 17: Principles of designing dies for facilitating their uses in the foundry.

APPRENTICES, TRAINING OF

Railways. A Railway Company's System of Engineering Apprenticeship. Eng. & Management, vol. 5, no. 24, June 16, 1921, pp. 692-694. Practice of Orleans Ry. Co. Translated from Revue générale des Chemins de Fer.

Systems. Apprenticeship System of the Southern Pacific Railway, Frank A. Stanley. Am. Mach., vol. 55, no. 1, July 7, 1921, pp. 12-15, 8 figs. Methods of instruction. Rates of pay while learning. Summary of periods of instruction.

Programs of Apprenticeship and Special Training in Representative Corporations, J. V. L. Morris. Am. Mach., vol. 54, no. 25, June 23, 1921, pp. 1081-1083, 1 fig. Plan of instruction followed in plant of Westinghouse Air Brake Co., Wilderming, Pa.

AUTOMOBILE ENGINES

Research. A Suggested Programme for Automobile Research, Geo. W. Watson. Automobile Engr., vol. 11, no. 151, June 1921, pp. 255-230. Utilization of low-grade fuel; alcohol, ether, benzol, and mixtures thereof; and solid fuels. Study of materials for valves, and design of pistons, piston rings and cylinders; cooling systems; silencers; lubrication; shafts; bearing metals; gears; spring suspension; brakes and transmission.

Vibrating Force. Running Balance and Uniformity of Crankshaft Effort in 8-Cylinder 60 Degree Vee Engines, P. M. Heldt. Automotive Industries, vol. 44, no. 26, June 30, 1921, pp. 1427-1429, 4 figs. Analytical study of vibrating forces in 8-cylinder Vee engine. One conclusion reached is that maximum vibrating force of 60 deg. eight-cylinder engine is only 61.2 per cent of that of 90 deg. 8-cylinder Vee engine.

AUTOMOBILE FUELS

Research. Influence of Various Fuels on Engine Performance—IV, H. R. Ricardo. Automotive Industries, vol. 45, no. 1, July 7, 1921, pp. 8-13 and 17, 6 figs. When all fuels are used with same compression ratio, power output is proportional to energy content of charge, but fuels which can be used with higher compression ratios without detonation are capable of developing higher maximum power than those which detonate at lower pressures. From Automobile Engr.

AUTOMOBILES

Body suspension. Examples of European Practice in Three and Four-Point Suspension, M. W. Bourdon. Automotive Industries, vol. 44, no. 26, June 30, 1921, pp. 1419-1420, 6 figs. Tendency is toward three-point type though majority of cars still employ four-point arrangement. One maker employs self-aligning ball bearing as support for extended front end of crankcase.

Design in U. S. The Trend of Design in the United States of America. Automobile Engr., vol. 11, no. 151, June 1921, pp. 215-217, 20 figs. Notes on 1921 New York automobile show.

Four-Wheel Brakes. Engineering Analysis of European Four-Wheel Brakes, W. F. Bradley and S. Gerster, Automotive Industries, vol. 44, no. 24, June 16, 1921, pp. 1267-1273, 20 figs. Engineering features of chief types and results of tests.

Front-End Drive. Problems of the Front-End Drive in Automobiles,J. Edward Schipper. Automotive Industries, vol. 44, no. 24, June 16, 1921, pp. 1296-1301, 16 figs. Typical three-wheel Morse silent chain drive. Present and future trend in front-end drive.

Manufacture. Manufacturing Methods on a Light Car. Automotive Engr., vol. 11, no. 151, June 1921, pp. 206-211, 18 figs. Tooling equipment at works of A. B. C. Motors, Ltd, Surrey, England.

Shock Absorbers. Suspension Shock Absorber for Automobiles. Sci. Am. Monthly vol. 4, no. 1, July 1921, pp. 69-70, 5 figs. Construction employing differential lever principle to meet variable conditions.

Transmission Gears. A New Transmission Designed to Facilitate Gear Shifting. Automotive Industries, vol. 44, no. 25, June 23, 1921, pp. 1366-1367, 6 figs. Secondary clutch completely disconnects tranmission from propeller shaft during interval of gear shafting. Shifting is accomplished by imparting rotary motion to slotted camshaft in gear box which actuates shifting yokes. Shifting lever mounted on steering column.

AVIATION

Civil Canada. Civil Aviation in Canada. Aviation, vol. 11, no. 2, July 11, 1921, pp. 45, 1 fig. Summary of Canadian civil aviation certificates and licenses issued during 1920 and the first five months of 1921.

France. French Aviation in 1921, Capt. de Lavergne. Aviation, vol. 10, no. 24, June 13, 1921, pp. 745-747. Developments in military and civil aviation.

French Aerial Navigation Regulations. Organization of French Aeronautics. Aerial Age, vol. 13, no. 16, June 27, pp. 367-368 and 365. Regulations for aerial navigation in France. Establishment of Nat. Meteorological Bur. Note from Nat. Advisory Committee for Aeronautics.

International Law. Aerial Navigation and International Law (La navigation Aérienne et le droit international), Henri Bouché. Aéronautique, vol. 3, no. 24, May 1921, pp. 216-220. Study of protocols befrre French senate. Centrifugal study.

Legislation. Air Navigation Directions—I. Aeronautics, vol. 20, no. 400, June 16, 1921, pp. 442-444, Survey of air navigation acts enacted from 1911-1919.

London-Paris Service. London-Paris Service. Aeronautics, vol. 20, no. 400, June 16, 1921, pp. 428-431, 3 figs' Report on installation work on engines, oil, water and gasoline systems, engine design, aeroplane design, etc. (To be continued).

Soaring Flight. Soaring and Gliding Experiments in Germany. Stamley Yale Beach. Aviation, vol. 11, no. 1, July 4, 1921, pp. 13-14, 2 figs. Records of flights made.

Technique. The Technique of Flight—II, R. M. Hill. Aeronautical Jl., vol. 25, no. 126, June 1921, pp. 301-311, 2 figs. Analysis of longitudinal balance of aeroplane.

B

BALANCING

Turbines. Four Years of Balancing Practice, N. W. Askinoff. Jl. Am. Soc. of Naval Engrs., vol. 33, no. 2, May 1921, pp. 261-267, 6 figs. Summary of facts established.

BEAMS

Non-Uniform Section. Deflection of Beams of Non-Uniform Section. U. S. War Dept., Air Service Information Circular, vol. 3, no. 213, April 30, 1921, 10 pp., 10 figs. Comparison of graphical and analytical methods of design,

Reinforced-Concrete. Reinforced-Concrete Beams—I, T. C. Broom. Mech. World, vol. 69, no. 1799, July 24, 1921, pp. 484-486, 1 fig. Graph for designing rectangular concrete beam with single reinforcement.

BEARING METALS

White-Metal. Some Properties of White Metal Bearing Alloys at Elevated Temperatures, John R. Freeman, Jr. and R. W. Woodward. U. S. Dept. of Commerce, Bur. of Standards, Technologic Papers, no. 188, April 5, 1921, 16 pp., 7 figs. Apparatus for determining yield point and ultimate strength white-metal bearing alloys at temperatures up to 100 deg. cent. Record of tests.

BEARINGS

Automobile Engines. Automobile Engine Bearings, W. Betterton. Metal Industry, (Lond.), vol. 18, no. 24, June 17, 1921, pp. 461-464, 7 figs. Formula for computing dimensions.

BEARINGS, BALL

Types. Comparison of various Types of Ball Bearings, H. R. Reynolds and R. W. Sellew. Am. Mach., vol. 54, no. 25, June 23, 1921, pp. 1065-1067, 7 figs. Relation between overall width tolerances and radial play mathematically demonstrated. Difference in radial play before and after mounting.

BENZOL

Specifications. British Standard Specification for Benzol for Motor Fuel. British Eng. Standards Assn., no. 135, Jan. 1921, 9 pp. 3 figs. Defined as liquid consisting essentially of mixture of benzene and not more than 30 per cent by volume of toluene and xylenes.

BLAST FURNACES

Design. Designing Hot Blast Stoves, W. E. Groume-Grjimailo. Iron Age, vol. 107, no. 25, June 23, 1921, pp. 1677-1680, 3 figs. Proprtioning passes and brickwork of checkers for work they have to do. Combustion and heat-transfer problems.

BOILER FEEDWATER

Degassing. Degassing and Purification of Boiler Feed-Water, Paul Kestner. Proc. Instn. Mech. Engrs., no. 4, June 1921, pp. 291-330 and (discussion) pp. 330-360, 21 figs. Physical and chemical study of reactions involved. Classification and description of methods.

Purification. Boiler Feed Water Purification, S. B. Applebaum. Chem. and Met. Eng. vol. 25, no. 1, July 6, 1921, pp. 23-26. Outline of respective merits of various methods used for boiler feedwater treatment, with special reference to advantages of Zeolite water-softening process.

BOILER FIRING

Oil Fuel. Liquid Fuel for Steam-Raising, N. A. Anfilogoff. Jl. Soc. Chem. Ind., vol. 40, no. 11, June 15, 1921, pp. 205R-209R, 4 figs. Typical conversion of Babcock and Wilcox boiler to oil fuel without alteration of brick work.

BOILER OPERATION

Draft Regulator. Wilkins Pressure Regulator, Power, vol. 53, no. 26, June 28, 1921, pp. 1041, 3 figs. Apparatus for draft and stoker control.

Factor of Evaporation. The Calculation of Boiler Performance, W. B. Campbell, Power House, vol. 14, no. 11, June 5, 1921, pp. 28-29, 1 fig. Graph for determining factor of evaporation.

Heat Balances. Calculating Boiler Heat Balances, H. D. Fisher. Combustion vol. 5, no. 1, July 1921, pp. 18-24, 7 figs. Graphs.

BOILERS

Cleaning. The Influence of Soot and Scale Removal on the Economy of Steam-Boiler Plants (Der Einfluss der Reinigung auf die Wirtschaftlichkeit der Dampfkesselanlage), M. Schimpf. Glückauf, vol. 57, no. 15, Apr. 9, 1921, pp. 345-346. Results of tests carried out on a double-flue boiler showing saving of 15 per cent of fuel through cleaning.

Electrically Heated. Useful Possibilities of the Electric Boiler (Nägot om den elektriska ängpannans användningsmojligheter), Otto Stälhanc. Teknisk Tidskrift, vol. 51, no. 4, Apr. 6, 1921, pp. 56-61, 8 figs.

Marine. *See Marine Boilers.*

Water Concentration. Concentration of Water in Steam Boilers, Victor J. Azbe. Power, vol. 54, no. 2, July 12, 1921, pp. 46-48, 4 figs. Description of densimeter, an apparatus for determining water concentration by sodium chloride method.

BRAKES

Electric vs Pneumatic. Experiences with Different Types of Brakes on the Berlin Street Railway (Erfahrungen mit verschiedenen Bremsarten bei der Berliner Strassenbahn), E. Kindler. Elektrische Kraftbetriebe u. Bahnen, vol. 19, no. 10, May 24, 1921, pp. 112-114, 1 fig. Experiences with pneumatic and electric brakes, from which it is concluded that the electric brake is best adapted for street-railway operation because of its simplicity and low cost of maintenance, Train. Improvements in Train Braking. Sci Am., vol. 124, no. 26, June 25, 1921, pp. 500-507, 4 figs. Combination of straight and automatic air braking designed for control of train on steep grades.

BRASS

High-Resistance. High-Resistance Brass, Pendleton Powell. Brass World, vol 17, no 12, June 1921, pp 151-153. Manufacture of special brasses and bronzes to resist large stresses, specially bronzes for ship propellers. Translated from Bulletin Technologique des Arts et Metiers

BUILDING CONSTRUCTION

Cost Accounting. Construction Accounting Under Uniform System. Elec. Rev. (Chicago), vol. 79, no. 1, July 2, 1921, pp. 6-9 Each item of expenditure classified and recorded in form to segregate costs on various plants and lines and of various specific parts of such plants and lines. Examples of accounts.

Construction Cost, W. N. Connor. Jl. Boston Soc. Civil Engr., vol. 8, no. 5, May 1921, pp. 157-197, 12 figs. Suggested forms for keeping records of costs in building construction.

Steel-Frame. Reducing the Cost of Steel-Frame Building, R. Fleming. Jl. Western Soc. of Engrs., vol. 26, no. 6, June 1921, pp. 220-229. Method of reducing cost of construction.

BRIDGES, CONCRETE

Cantilever Arch. Double-Drum and Cantilever Arches, Daniel B. Luten. Eng. World, vol. 19, no. 1, July 1921, pp. 11-15, 17 figs. Typical structures

BRIDGES, HIGHWAY

Concrete Floors. Concrete Highway Bridge Floors. Eng. World, vol. 19, no. 1, July 1921, pp. 7-9, 8 figs. Typical designs developed in several states.

BRIDGES, SUSPENSION

Camden-Philadelphia. Bridging the Delaware at Philadelphia. Am. Sci., vol. 125, no. 1, July 2, 1921, pp. 8-9, and 15-16, 6 figs. Two-cable suspension bridge with main span of 1750 ft. about to be constructed across Delaware to join Camden with Philadelphia.

Engineering Studies for Philadelphia-Camden Bridge. Eng. News-Rec., vol. 86, no. 25, June 23, 1921, pp. 1086-1090, 5 figs. Location fixed by traffic, street conditions and cost. Rock at 100 ft. depth. Single-span superstructure with 135 ft. clearance height. Suspension bridge cheaper than cantilever.

C

CABLES, ELECTRIC

Soldering Sockets. British Standard Specification for Electric Cable Soldering Sockets. British Eng. Standard Assn., no. 91, Feb. 1921, 8 pp. 3 figs. For cables from 0.0018 to 1,000 sq. in. sectional area.

CABLEWAYS

Aerial. Aerial Cableways (Les transporteurs aériens à cables), F. Cretin. Génie Civil, vol. 78, no. 19, May 7, 1921, pp. 385-390, 4 figs. Study of stresses in cable and resistance of carriage to travel. Notes on design.

CANALS

New York State Barge Canal. Economical Transportation on the New York State Canal—IV, Motorship, vol. 6, no. 7, July 1921, pp. 558-559, 4 figs. Economical comparison of barges of various types.

CARS

Couplings. Impact and Its Relation to Damage Claims, J. A. Pilcher. Ry. Age, vol. 71, no. 2, July 9, 1921, pp. 77-79, 1 fig. Graph showing relation between speed at which cars are coupled and force of impact. Evils are avoided when speed does not exceed 2 miles an hour.

CARS

Electric. Some Recent Interurban Car Designs. Elec. Ry., Jl., vol. 58, no. 1, July 2, 1921, pp. 6-10, 13 figs. Trend of practice in construction of all-steel electric-railway cars.

Welland, Canada. Canada's Great Ship Canal, J. F. Springer. Sci. Am., vol. 124, no. 26, June 25, 1921, pp. 504-505, 4 figs. Present status and ultimate plans of Welland improvement.

Heavy types. Heavy Locomotives for the Southern Pacific. Ry. Age, vol. 71, no. 1, July 2, 1921, pp. 15-17, 4 figs. Pacific and Santa Fe types. Characteristics Pacific, tractive effort, 43,660 lb.; cylinders, 25 in. by 30 in.; weight, total engine, 297,800 lb.; wheelbase, driving, 13 ft.; Santa Fe, tractive effort, 75,150 lb.; cylinders, 29½ in. by 32 in.; weight, total engine, 385,900 lb.; wheelbase, driving, 22 ft. 10 in.

Insulation. Insulation of Freight and Passenger Cars, Wm. N. Allman. Ry. Mech. Engr., vol. 95, no. 7, July 1921, pp. 444-449, 3 figs. Theoretical and practical considerations; values of various materials; calculating heat transmission.

CARS, FREIGHT

Draft-Gear tests. Draft Gear Tests of the Railroad Administration Ry. Mech Engr., vol. 95, no. 7, July 1921, pp 435-441, 6 figs Car-impact tests at T. H Symington Co. testing plant at Rochester, N. Y. Methods of combining and interpreting records

CARS, MAILS

Unit-Container. Epoch-Making Experiments with Unit-Container Mail Cars. Transportation World, vol 3, no. 4, June 1921, pp 11-12, 2 figs. Removable container cars operated by New York Central

CARS, REFRIGERATOR

Inspection. Transportation Economics of the Refrigerator Car, H. R. Newlean. A.S.R.E. Jl., vol. 7, no 5, Mar 1921, pp. 383-389 Inspection practice of Fruit Dispatch Co., vendors for United Fruit Co.

CARBURETORS

Tests. Trials of German Carburetors for Using Non-Volatile Fuels, Benno R. Dierfeld. Automotive Industries, vol. 45, no. 1, July 7, 1921, pp. 4-5, 2 figs. Winning instruments in competitive tests made partly on road and partly on laboratory testing stand.

CAST IRON

Research. British Iron Research Association Meets, Joseph Horton Foundry, vol. 49, no. 13, July 1, 1921, pp. 531-532. Progress made in development of British Cast Iron Research Association.

CEMENTS

Acid-Proof. Acid-Proof Cements. (Säurefeste Kitte) H. Kleinlogel. Chemiker-Zeitung, vol. 45, no. 54, May 5, 1921, pp. 432-433. Satisfactory results obtained from tests with cements from firm of Rössler, Benshelm, Germany, to be used for lining reinforced-concrete containers for different kinds of acids.

CENTRAL STATIONS

Operation. Organization and Operation of Inter-connected Electric connected Electric Plants (L'esprit des groupements de centrales, leur organisation—Leur exploitation), Fernand Courtoy. Association des Ingénieurs électriciens sortis de l'Institut Electro-technique Montefiore, vol. 3, no. 5, 1921, pp. 99-146, 15 figs. Regulations for establishment of corporations to engage in exploitation of centralized electrical systems. Technical and financial study.

CENTRIFUGALS

Water-Driven. Some recent developments in Water-Driven Centrifugals, F. J. Broadbent Engineering, vol. 111, no. 2894, June 17, 1921, pp. 744-745, 6 figs. Pelton-wheel-driven machines with cage of 723 in. diameter

CHEMICAL INDUSTRIES

Prohibition and. Alcohol and the Chemical Industries, J. M. Doran. Jl. Indus. & Eng. Chemistry, vol. 13, no. 6, June 1921, pp. 564-565. Plea for regulation of prohibition in such manner as not to interfere with chemical industries.

CLUTCHES

Design. American and British Practice in Clutch Design, Herbert Chase. Automotive Industries, vol. 44, no. 24, June 16, 1921, pp. 1302-1313, 28 figs. Advantages and disadvantages of various types of clutches are discussed and merits and demerits of many design features pointed out. Notes on theory of design and tabulation of dimensions, pressures, capacity, etc. of many makes.

Practice and Theory in Clutch Design, Herbert Chase. Jl. Soc. of Automotive Engrs., vol. 9, no. 1, July 1921, pp. 39-52, 28 figs. Comparative study of American and British practices in clutch design.

Hydraulic. High-powered Hydraulic-Clutch for Diesel-Driven Tankers. Motorship, vol. 6, no. 7, July 1921, pp. 579, 1 fig. Tests by British Admiralty of Hele-Shaw device for motorships.

COAL DUST

Sampling. Coal-Dust Sampling and Methods Adopted in Practice, R. C. Smart. Iron & Coal Trades Rev., vol. 101, no. 2779, June 3, 1921, pp. 753-754, 3 figs. Regulations of British Navy. Paper read before South Wales Inst. Engrs.

COAL HANDLING

Piers. Mechanical Trimmers Facilitate Coal Loading, P. G. Lang, Jr. Ry. Age, vol. 70, no. 25, June 24, 1921, pp. 1433-1436, 5 figs. Baltimore & Ohio installation at Curtis Bay piers, Md.

COAL MINING

Thick Seams. Hydraulic Packing in Thick Coal Seams, H. M. Tarlton. Trans. Min. & Geological Inst. of India, vol. 15, part 2, April 1921, pp. 107-116 and (discussion) pp. 116-122, 4 figs. on 4 supp. plates. Coal mining by hydraulic packing combined with machine coal-cutting and mechanical coal-face conveyors.

COAL TIPPLES

Construction. Among Other Preparation Devices at Diamond Mines is One for Picking Each Separately, Donald J. Baker. Coal Age, vol. 19, no. 25, June 23, 1921, pp. 1111-1116, 8 figs. Cars brought to feeder by rope are fed to dump which revolves completely over, cars being held by wheel clamps. Reciprocating screens hang from rods and do not rest on rollers.

COBALT STEEL

Analysis. The Determination of Cobalt and Nickel in Cobalt Steels, G. E. F. Lundell and J. I. Hoffman. Jl. Indus. & Engr. Chemistry, vol. 13, no. 6, June 1921, pp. 540-543. Method based on electrodeposition of cobalt and nickel in solution freed from iron, chromium, tungsten, molybdenum, vanadium and copper.

COKE

Breeze. Boiler Fuel Mixture Tests, John Blizard and James Neil. Gas Rec., vol. 19, no. 12, June 22, 1921, pp. 25-27 and 34, 3 figs. Experiments conducted at Bur. of Mines to determine steaming value of coke breeze when mixed with Pittsburgh coal and fired by hand.

Metallurgical. Notes on the Value of Metallurgical Coke, G. Deladriere. Colliery Guardian, vol. 121, no. 3154, June 10, 1921, pp. 1668-1669, 4 figs. Graphs comparing relative values of different grades of coal. Translated from Revue universelle des mines.

COKE OVENS

By-Products. Adaptability in Coke Oven Practice, C. R. Meissner. Gas Age, vol. 47, no. 12, June 25, 1921, pp. 503-506, 5 figs. Among features of Hazelwood plant are concrete casings for exhausters and boosters and flushing of collecting mains with condensate.

Plants. New Coke Oven at St. Louis, Hector Prud'homme. Gas Rec., vol. 19, no. 12, June 22, 1921, pp. 19-23, 5 figs. Eight Piette type of ovens installed at plant of Laclede Gas Light Co. for test purposes. Thirty-day test run shows splendid results.

COLD SAWS

Use in Steel Works. The Use of High-Speed Cold Saws with Toothless Blade in Steel Works and Foundries (Verwendung schnellaufender Kaltsägen mit zahnolsem Sägeblatt in Hüttenwerken und Stahlgiessereien), A. Lobeck. Werstattstechnik, vol. 15, no. 12, June 15, 1921, pp. 351-353, 12 figs. Describes new cutting method for use with steel castings of a given shape and hardness.

COMBUSTION

Flue-Gas Analysis. Determination of excess Air From Flue-Gas Analysis, R. Brown. Combustion, vol. 4, no. 6, June 1921, pp. 24-25, 1 fig. Construction of excess air chart.

COMPRESSED AIR

Waste. Saving Fuel by Decreasing Air Waste, N. A. Craigue. Indus. Management, vol. 61, no. 11, June 1, 1921, pp. 418-421, 3 figs. Methods of reducing waste and diminishing leaks in compressed air systems.

CONCRETE

Alkali Action. Progress in Investigation of Alkali Action on Concrete, E. C. Bebb. Concrete Products, vol. 20, no. 6, June 1921, pp. 27-29. Investigations conducted by Bur. of Standards, Reclamation Service, Drainage Investigations Office of Dept. of Agriculture and Portland Cement Assn.

Oven Drying. Effects on Concrete of Immersion in Boiling Water and Oven Drying, W. J. Schlick. Iowa State College of Agriculture & Mechanics Arts Official Publication, vol. 19, no. 44, Mar. 30, 1921, 24 pp., 13 figs. Experiments Boiling without previous drying caused reduction in weight, while boiling following oven drying caused increase in weight, there having been marked loss in strength in each case.

Waterproofing. Some Methods of Securing Impermeability in Concrete, Ewart S. Andrews. Concrete & Constructional Eng., vol. 16, no. 6, June 1921, pp. 369-374. Classification of methods for securing impermeability. paper read before Concrete Inst.

Waterproofing Concrete—I, J. H. Burgess. Commonwealth Engr., vol. 8, no. 8, Mar. 1, 1921, pp. 248-250. Permeability tests.

CONCRETE CONSTRUCTION

Gravity Plants. Graphic Wattmeter Checks Gravity Plant Operation. Eng. News-Rec., vol. 86, no. 25, June 23, 1921, pp. 1067-1068, 3 figs. Details of distant operations indicated on chart at construction engineers' desk.

CONCRETE CONSTRUCTION, REINFORCED

Developments. Modern Reinforced Concrete Industrial Structures (Moderne strutture industriali in cemento armato), Luigi Santarella. Industria, vol. 35, no. 8, April 30, 1921, pp. 175-179 and 180-181, 16 figs. Typical factory constructions.

CONDENSERS, STEAM

Cleaning. Removing Scale from Surface Condenser Tubes with Hydrochloric Acid, Norman G. Hardy. Power, vol. 54, no. 1, July 5, 1921, pp. 22-24, 1 fig. Apparatus and process described.

Acid Cleaning of Condensers, Norman G. Hardy. Elec. World, vol. 78, no. 2, July 9, 1921, pp. 64, 1 fig.

Developments. Recent Improvements in the Design of Condensers for Steam Engines (Recents Perfectionnements des appareils de condensation des machines à vapeur d'eau); L. Jauch. Chaleur et Industrie, vol. 2, no. 13, May 1921, pp. 239-246, 3 figs. Technical study and historical survey. (To be continued.)

CONNECTING RODS

Machining Methods. Another Method of Machining Connecting Rods, Fred H. Colvin. Am. Mach., vol. 54, no. 25, June 23, 1921, pp. 1068-1069, 5 figs. Methods and fixtures. Facing both ends of boss at once. Drilling machine with special attachment. Boring two rods in one operation.

Machining Connecting Rods. Eng. Production, vol. 2, no. 38, June 23, 1921, pp. 744-746, 11 figs. Methods employed at leading automobile factories.

CONVEYORS

Workshop. Mechanical Conveyors for Workshops, Hubert Hermans. Forging & Heat Treating, vol. 7, no. 6, June 1921, pp. 316-319, 10 figs. Types used in German workshops.

COPPER

Gases, Action on. The Action of Reducing Gases on Heated Copper, H. Moore. and S. Beckinsale. Engineering, vol. 111, no. 2893, June 10, 1921, pp. 729-732, 8 figs. Results obtained in experiments showed that injurious effect of reducing gases on heated copper is result of their interaction with cuprous oxide always present in commercial copper. Markedly injurious effect is produced even when oxygen content of copper does not exceed 0.026 per cent. Paper read before Inst. of Metals.

COPPER ALLOYS

Copper-Tin. The Constitution of the Alloys of Copper with Tin-III and IV, John L. Haughton. Engineering, vol. 111, no. 2895, June 24, 1921, pp. 789-793, 23 figs. Transformations occurring below eutectic temperature. Photomicrographs.

CORROSION

Protective Treatments. Notes on Oxydizing Cementation, Galvanization, Sherardizing and Metalizing By Pluverization (La cimentation oxcidante. La galvanisation. La shérardisation. La métallisation par pulvérisation), J. Arnoul de Grey. Chaleur et Industrie, vol. 2, no. 13, May 1921, pp. 255-262. Exposition and comparative study of methods of protecting metallic objects against corrosion. (To be continued.)

COST ACCOUNTING

Overhead Costs. Budgeting Factory Overhead, E. E. Carlson. Factory, vol. 27, no. 1, July 1, 1921, pp. 31-34, 4 figs. Experience in operation of budget plans of Fairbanks, Morse & Co. and A. O. Smith Corp.

Uniform System. Advises Use of Uniform Cost System, Robert E. Belt. Foundry, vol. 49, no. 13, July 1, 1921, pp. 524-526. Economical advantages of introducing uniform cost system in manufacturing plants. Paper read before National Industrial Cost Conference.

COUPLINGS

Whitney Free Floating. Whitney Free Floating Coupling. Power, vol. 54, no. 1, July 5, 1921, pp. 24, 2 figs. Designed to allow for misalignments, either parallel or angular. Coupling consists of two hubs and special design of driving link.

CRANES

Tower. Tower Crane for Handling Timber. Engr., vol. 131, no. 3415, June 10, 1921, pp. 624-625, 1 fig. Designed to deal with loads of 5 tons at radius of 50 ft. and of 3 tons at radius of 100 ft.; with clear height of lift of 52 ft.

CRANKCASES

Machining Operations. Details of Crankcas, Works Am. Mach., vol. 54, no. 25, June 23, 1921, pp. 1088-1090, 9 figs. Different types of reaming fixtures. "Hand" reaming by pneumatic motor. Running in crankshaft bearings by power. Roller conveyors as labor savers.

CUPOLAS

Clays for Daubing. Cupola Daubing Clay Affects Iron, Carl Buberl. Foundry, vol. 49, no. 13, July 1, 1921, pp. 533-534. Poor and good clays for daubing cupola are defined and results of tests showing detrimental effects of poor grade of refractory given. Aluminum additions improve quality.

Oil Firing. Oil Lowers Cost of Fuel in Cupola, Karl K. Berthold. Foundry, vol. 49, no. 13, July 1, 1921, pp. 530-531. Experience at Austrian Foundry. Oil was introduced as adjunct to coke in cupola and cost of fuel was decreased in consequence as well as metal with lower sulphur content was obtained. Translated from Stahl U. Eisen.

Operation. Fitting the Cupola to Its Work, Y. A. Dyer. Iron Age, vol. 107, no. 25, June 23, 1921, pp. 1675 and 1727-1729. Cupola operation. Physical and chemical factors as related to efficiency. Position of fusion zone.

CUTTING TOOLS

Design. Metal Cutting Tools—XII, A. L. DeLeeuw. Am. Mach., vol. 55, no. 1, July 7, 1921, pp. 4-9, 13 figs. Form tools; plate tools, bar tools and circular form tools. Advantages and disadvantages of each. Shaving tools and their action.

D

DIE CASTING

Developments. Latest Developments in the Die Casting Industry. Raw Material vol. 4, no. 5, May 1921, pp. 156-163, 13 figs.

DIESEL ENGINES

Solid-Injection. Injection and Combustion of Fuel-Oil IV, C. J. Hawkes. Motorship, vol. 6, no. 7, July 1921, pp. 573-574, 1 fig. Experiments with solid injection and air blast in marine Diesel-engines. (Continuation of serial.)

Standardized. Standardised Diesel Engines V, H. R. Sets. Mar. Eng., vol. 26, no. 7, July 1921, pp. 548-552, 7 figs. Discussion of double acting two-cycle engine and its possibilities.

DRAWINGS

Filing. Systems for Indexing and Filing Drawings. Eng. & Contracting, vol. 55, no.25, June 22, 1921, pp. 609-611, 4 figs. Systems used by five prominent engineering and manufacturing enterprises. Paper read before Cleveland Eng. Soc.

DRILLING MACHINES

Manufacture. Building Drilling Machines. Engr. Production, vol. 2, no. 36, June 9, 1921, pp. 694-703, 24 figs. Methods at works of Associated British Machine Tool Makers, Halifax.

Multiple-Spindle. Drilling Two Different Parts on One Machine, J. H. Moore. Can. Machy. vol. 25, no. 25, June 23, 1921, pp. 25-27, 9 figs. Uses and advantages of multiple-spindle drilling machines. Typical examples of work.

Heavy Multiple-Head Drilling Machines. Engineering, vol. 111, no. 2893, June 10, 1921, pp. 714 and 716, 2 figs. Designed by Beyer, Peacock & Co., Manchester, England, to meet requirements of locomotive and marine engine shops.

DROP FORGING

Ingots for. Billets for the Drop Forger, Harry Brearley. Forging & Heat Treating, vol. 7, no. 6, June 1921, pp. 307-313, 13 figs. Cracks, blowholes, pipe and segregates in ingots, and laps, roaks, burning clinks, flash and remnant defects in forgings are discussed.

Plants. Drop-Forge Plant Lay-Out and Equipment. Machy. (N.Y.), vol. 27, no. 11, July 1921, pp. 1039-1041, 9 figs. Drop-forging plant arranged for handling large quantities of work.

DUST

Measurement of Dustiness. The Shinizu-Wilson Cloud-Condensation Apparatus. Elecn., vol. 86, no. 2247, June 10, 1921, pp. 720, 2 figs. Apparatus for measuring dustiness of atmosphere. Modifications of Wilson cloud-condensation apparatus.

E

EDUCATION, ENGINEERING

Problem of. How should the Engineer Be Educated? F. L. Bishop, Knox Taylor, Comfort A. Adams, W. C. Spruance, Moorhead C. Kennedy, R. E. Anderson and Donald A. Hampson. Am. Mach., vol. 54, no. 26, June 30, 1921, pp. pp. 1105-1109. Résumé of remarks expressed at joint meeting of Am. Soc. of Mech. Engrs. and Am. Inst. Elec. Engrs.

ELASTICITY

Moduli. Elasticity. Engineering, vol. 111, no. 2893, June 10, 1921, pp. 701-702, 13 figs. Derivation of formula expressing relation between moduli of elasticity.

ELECTRIC CIRCUITS, A. C.

Overvoltages. Principal Modern Methods for Automatically Dividing Electric Circuits Into Sections in Case of Overvoltage (Les principales méthodes modernes de sectionnement automatique des circuits électriques en cas de surintensité) D. Scoumanne. Revue générale de l'Electricité, vol. 9, no. 24, June 11, 1921, pp. 843-851, 3 figs. Apparatus used in high-tension three-phase installations. (To be continued).

ELECTRIC CONDUCTORS

Resistance. Chart for Determining Variations with Temperature in Resistance of Electric Conductors ((Abaque pour déterminer les variations correlatives de la résistance ohmique et de la température des conducteurs,), J. Yernaux. Société Belge des Electriciens, vol. 35, Mar-April 1921, pp. 50-52, 2 figs.

ELECTRIC DISTRIBUTION

Aerial Cables. Power Distribution Over Aerial Cables, F. A. Westbrook. Elec. World, vol. 77, no. 25, June 18, 1921, pp. 1411-1414, 2 figs. Advantages of aerial cables over open wires. Lead-covered, paper-insulated cables are advocated.

ELECTRIC DRIVE

Logging Industry. Electric Applications in the Logging Industry of the Northwest, E. P. Whitney. Gen. Elec. Rev., vol. 24, no. 7, July 1921, pp. 631-638, 8 figs.

Pumps. Electric-Motor Drives for Pumps, Gordon Fox. Power, vol. 54, no. 1, July 5, 1921, pp. 2-5, 5 figs. Advantages of reciprocating and centrifugal pumps. How to figure capacities and power required. Operating characteristics. Types of motor to use for different kinds of service.

Textile Industry. Selection of Polyphase Motors, Benjamin F. Bailey. Elec World, vol. 78, no. 1, July 2, 1921, pp. 16-19, 7 figs. Electric drive in textile industry. Comparison of electrical and physical characteristics that affect service requirements. Choice of speed, frequency weight and rating are considered. Squirrel-cage compared with wound-rotor motor.

Inductive. Recent Progress in High-Frequency Inductive Heating, E. F. Northrup. Chem. & Metallurgical Eng., vol. 24, no. 25, June 22, 1921, pp. 1097-1100, 5 figs. Notes on design, operation, melting rate and power input of electric furnaces using high-frequency inductive heating. Electric furnaces are being used for melting precious metals at U.S. mint and by leading silver broker. Paper read before Am. Electrochemical Soc.

ELECTRIC GENERATORS, D. C.

Three-Brush. Dynamos with Three-Brushes (Dynamos à trois balais). Bulletin de la Société Francaise des Electriciens, vol. 1, no. 2, Feb. 1921, pp 31-66, 31 figs. Properties and characteristics. Study of automatic regulation. Applications to electric lighting of automobiles and trains.

ELECTRIC MEASURING INSTRUMENTS

Repairing. Repairing Electrical Switchboard Instrument, Victor H. Todd. Power, vol. 53, no. 26, June 28, 1921, pp. 1044-1047, 9 figs. Detection of causes of failure.

ELECTRIC MOTORS

Coil Winding. Order System for Coil-Winding Shop, A. C. Roe. Elec. World, vol. 78, no. 2, July 9, 1921, pp. 65-70, 4 figs. Instruction cards used in motor-repair shop of Westinghouse Electric & Mfg. Co.

ELECTRIC MOTORS, A. C.

Controllers. Alternating-Current Controllers Automatically Operated, G. J. Kirkgasser and E. W. Seeger. Elec. Rev. (Chicago), vol. 78, no. 26, June 25, 1921, pp. 1011-1015, 13 figs. Principle and application of motor-control apparatus. Squirrel-cage, slip-ring and synchronous motors. Types of starting and regulating devices.

Induction. The Squirrel Cage and Wound Rotor Induction Motors, Engineering, vol. 111, no. 2894, pp. 755-756, 6 figs. Performance curves.

Polyphase. Notes on the Diagram of Polyphase Commutator Motors (Rematques sur le diagramme des moteurs polyphases à collecteur), A. Blondel. Revue générale de l'Electricité, vol. 9, no. 24, June 11, 1921, pp. 835-840, 4 figs. General method for constructing diagrams applicable to study of alternating-current commutator rotating-field machines.

ELECTRIC PLANTS

Interconnection. Power Administration Effects Economy, Fred B. Lewis. Elec. World, vol. 78, no. 2, July 9, 1921, pp. 57-58, 4 figs. Methods which have been adopted in California to operate steam and hydro-electric plants for maximum efficiency and economy of resources.

ELECTRIC POWER

Bases for Rates. Establishment of Rational Tariff for Electric Power Rates (Etudes pour l'établissemnt d'un tarif rationnel de vente), G. Viel. Revue générale de l'Electricité, vol. 9, no. 23, June 4, 1921, pp. 807-812, 9 figs. Mathematical study.

Trolley Wires. Construction and Maintenance of Catenary System, F. W. Bellinger. Elec. Traction, vol. 17, no. 6, June 1921, pp. 373-377, 3 figs. Experience of Butte, Anaconda & Pacific Ry. Co.

ELECTRIC SWITCHES

Automatic. Operating Features of Automatic Switching Equipment, Chester Lichtenberg. Elec. Rev. (Chicago), vol. 78, no. 25, June 18, 1921, pp. 963-966' 6 figs. Typical installations.

ELECTRIC TRANSMISSION

220,000-Volt. Economics of 220,000-Volt Transmission, J. P. Jollyman. Jl. Electricity & Western Industry, vol. 47, no. 1, July 1, 1921, pp. 10, 1 fig. Graph showing characteristics of 200-mile 60-cycle circuits. Paper read before San Francisco section, Am. Inst. Elec. Engrs.

220,000 Volts. Factors Affecting Long-Distance Bulk-Power Transmission. Elec. World, vol. 77, no. 26, June 15, 1921, pp. 1477-1480, 7 figs. Voltage regulation of 220-kv. lines can be insured by proper distribution of synchronous condensers. Methods of minimizing insulator destruction from flashover.

ELECTRIC WELDING

Castings. Application of Arc Welding in Machinery Construction, A. M. Candy. Elec. Rev. (Chicago), vol. 79, no. 1, July 2, 1921, pp. 1-5, 7 figs. Heavy castings damaged in shop or in operation repaired with speed by welding process. Forging weld increased its strength and quality. Paper read before Soc. of Refrigerating Engrs.

Railway Shops. Electric Arc Welding in Railroad Shops, A. M. Candy. Ry. Mech. Engr., vol. 95, no. 7, July 1921, pp-456-458, 7 figs. Explanation of the Characteristics of arc-deposited metal and some samples of welding.

ELEVATORS

Freight, Safeguarding. Freight Elevators. Power Plant Eng., vol. 25, no. 13, July 1, 1921, pp. 667-669, 3 figs. Safeguarding shaftways, cables, counterweights, and operations. Prepared by eng. staff of Nat. Safety Council.

Governors. Electric Elevator Machinery, Overspeed Governors, M. A. Myers. Power, vol. 54, no. 2, July 12, 1921, pp. 50-51, 13 figs. Types of safety governrs.

ENAMELLING

Steel. The Vitreous Enamelling of Steel and Iron, Charles M. Bowes. Metal Industry (London), vol. 18, no 23, June 10, 1921, pp. 441-442. Outline of processes.

ENGINEERS

Licensing. Ethical and Practical Considerations Regarding the Engineering Corporations. Eng. News-Rec., vol. 86, no. 26, June 30, 1921, pp. 1109-1111. Holds that ethical questions are not essentially different from those confronting individual consultants.

EXHAUST STEAM

Utilization. Generating Power with Exhaust from Mill Engines. Power Plant Eng., vol. 25, no. 13, July 1, 1921, pp. 641-646, 10 figs. Mixed pressure turbines and regenerators installed at plant of National Enamelling & Stamping Co.

EXPLOSIVES

Liquid Oxygen. The Potentialities of Liquid Oxygen Explosives, Robert G. Skerrett. Compressed Air Mag., vol. 26, no. 6, June 1921, pp. 10103-10107, 7 figs. Use of liquid oxygen in German mines.

F

FACTORY MANAGEMENT

See Industrial Management.

FIRE PREVENTION

Exposed Woodwork. Ignitions of Combustible Materials, Especially Exposed Woodwork, by Heat-Producing Apparatus, C. E. Worthington. Safety Eng., vol. 41, no. 6, June 1921, pp. 256-263, 2 figs. Protecting devices, notably for metal smokestacks and insulation for smoke pipe.

FILTERS, SAND

Absorption. Absorption in Sand Filters, John Don. Engineering, vol. 111, no. 2894, June 17, 1921, pp. 759- 760, 2 figs. Experiments made with ordinary sand, crushed quartz and felspar, in order to find out the law of absorption by these substances in regard to ammonia, both ordinary and organic. Paper read before Instn. Water Engrs.

FIRECLAYS

Thermal Expansion. The Reversible Thermal Expansion of Fireclay and Other Refractory Materials, H. S. Houldsworth and John W. Cobb. Jl. Soc. Glass Technology, vol. 5, no. 17, May 1921, pp. 16-38, and (discussion) pp. 38-44, 12 figs Reversible thermal expansion up to 100 deg. cent. were determined for fireclay, fireclay mixtures, ganister, alumina magnesia and carborundum.

FOREMEN

Training. Practical Methods of Training Foremen, S. Gordon Taylor. Indus. Management, vol. 62, no. 1, July 1, 1921, pp. 23-26. Experience in organization of welfare work in shipyard.

FORGINGS

Metal Involved. Chart for Determining Metal Involved in Forgings, H. Kilborn. Forging & Heat Treating, vol. 7, no. 6, June 1921, pp. 314-315, 1 fig.

See also Oil Fuel; Pulverized Coal.

FURNACES, ANNEALING

Oil-Fuel-Burning. Anneals Malleable with Fuel Oil, William F. Hoernke. Iron Trade Rev., vol. 68, no. 25, June 23, 1921, pp. 1728-1730, 4 figs. Conversion of coal burning annealing ovens into oil burning ovens. Operation shows that although oil is more expensive fuel, it requires less labor in handling and firing.

FURNACES, BOILER

Insulation. Boiler Furnace Insulation, Frank W. Sterling. Jl. Am. Soc. of Naval Engrs., vol. 33, no. 2, May 1921, pp. 268-284, 10 figs. Methods of testing furnace insulation.

Continuous. Heating Furnaces and Annealing Furnaces, W. Trinks. Forging & Heat Treating, vol. 7, no. 6, June 1921, pp. 320-324, 6 figs. Comparison of different types of continuous furnaces. Test results.

Research. Investigation of Warm-Air Furnaces and Heating Systems, A. C. Willard, A. P. Kratz and V. S. Day. University of Ill. Bul. vol. 18, no. 29, Mar. 21, 1921, 145 pp., 49 figs. Determination of Efficiency and capacity of commercial warm-air furnaces under conditions similar to those existing in actual installations with leaders, stacks, and registers, to form complete system; study rating furnaces and investigations of value of insulating materials as affecting economy of furnace.

FURNACES, HEAT-TREATING

Gas. The Value of Gas for Heat Treating, F. F. Cauley. Forging & Heat Treating vol. 7, no. 6, June 1921, pp. 328-331, 8 figs. Typical modern installations.

G

GAGES

Industrial. Study of Industrial Gages at International Bureau of Waste and Measures (L'étude des calibres industriels au bureau international des poids et mesures), Albert Perard. Génie Civil, vol. 78, no. 23, June 4, 1921, pp. 477-480, 11 figs. Types of gages employed. (To be continued).

Inspection. The Delco Inspection System, Erik Oberg. Machy. (N.Y.), vol. 27, no. 11, July 1921, pp. 1032-1034, 8 figs. Descriptions of methods used in tool and gage designing dept. of Dayton Eng. Laboratories Co., and standards of gaging adopted.

Lever. The Accuracy of Multiple Lever Gages (Die Genauigkeit mehrfacher Fühlhebel), G. Berndt. Werkstattstechnik, vol. 15, no. 12, June 15, 1921, pp. 347-350, 2 figs. Comparison of accuracy of single and multiple levers. States that, when possible, instead of using several levers with smaller gear ratios, it is better to use a double or single lever with gear ten times as great.

GAS TURBINES

Combustion Chambers. Gas-Turbine Combustion Chambers, Glenn B. Warren. Power vol. 53, no. 26, June 28, 1921, pp. 1059-1060, 2 figs. Experiments at University of Wisconsin on four types of combustion chambers.

GEAR CUTTING

Continuous Machines. Generating Gear Teeth for Industrial Uses, J. H. Moore. Can. Machy., vol. 25, no. 23, June 9, 1921, pp. 25-27, 8 figs. Continuous type of gear-cutting machines.

Helical Gears. Cutting Large Double Helical Gears, C. S. Pettit. Machy. (Lond.) vol. 18, no. 454, June 9, 1921, pp. 308-309, 4 figs. Machines developing continuous teeth by means of rack cutter using reciprocating motion

GEARS

Bevel. The Spiral Bevel Gear, Machy. (Lond.), vol. 18, no. 456, June 23, 1921, pp. 352-354, 3 figs. Matterson type of spiral bevel gear. Criticism of article in Machy. (Lond.), May 12, p. 174.

Inspection. A New System of Gear Grinding and Gear Inspection, P. M. Gear Inspection, P. M. Heldt. Automotive Industries, vol. 44, no. 26, June 30, 1921, pp. 1430-1431, 4 figs. Great accuracy of tooth and more rolling with less sliding action are claimed. Grinding machine works on generating principle and means for compensating for wear of grinding wheel is provided.

Involute. The Evolution of the Involute Gear Tooth—VI, A. Fisher. Machy. (Lond.), vol. 18, no. 456, June 23, 1921, pp. 363-366, 7 figs. Influence of pressure angle on strength of teeth.

Non-Metallic. Design and Manufacture of Non-Metallic Gears, Fred R. Daniels. Machy. (N.Y.), vol. 27, no. 11, July 1921, pp. 1005-1011. Characteristics of gears made from rawhide and fabric-base materials. Methods employed by Van Dorn & Dutton Co., Cleveland, O., in manufacture of non-metallic gears.

Skew. Skew Gear Design, F. E. Lindsay. Engineer, vol. 131, no. 3416, June 17, 1921, pp. 652, 5 figs. Graphical method.

Spur. Spur Gear Erosion, F. W. Lanchester, Engineering, vol. 111, no. 2894, June 17, 1921, pp. 733-734, 7 figs. Limitations of conditions under which it is desirable to use rolling rather than sliding contact. Difficulties which are liable to be associated with rolling conditions.

Testing Teeth. The Odontometer for Testing Gear Teeth, Earle Buckingham. Machy. (N.Y.), vol. 27, no. 11, July 1921, pp. 1029-1031, 6 figs. Apparatus consists of section of straight-sided rack with two parallel effective faces, one being fixed and other movable. Third face, set at angle to two working faces, is used to hold fixed working face in contact with flank of gear tooth.

GRINDING MACHINES

Continuous. The Churchill Continuous Rod Grinding Machine. Machy (Lond.), vol. 18, no. 455, June 16, 1921, pp. 333-336, 3 figs. Machine manufactured by Churchill Machine Tool Co., Manchester, England.

H

HANDLING MATERIALS

Small Plants. Purchasing and Handling Material in the Small Plant—II and III, Guy V. Sweet. Indus. Management, vol. 61, no. 11, and vol. 62, no. 1, June 1, and July 1, 1921, pp. 399-402, 6 figs. and 18-21, 7 figs. June 1: Forms for keeping records and making requisitions. July 1: Forms of materrial record cards.

HEATING

Industrial Local. Industrial Applications of Local Heating with the Pyrotip, E. A. Wagner. Gen. Elec. Rev., vol. 24, no. 7, July 1921, pp. 628-631, 10 figs. Heat is generated at tip of carbon rod and is transmitted by conduction to material; it is produced by resistance of carbon tip to passage of electric current.

HEATING AND VENTILATION

Humidifying Apparatus. Humidifying Apparatus for Textile Factories. Engineer, vol. 131, no. 3416, June 17, 1921, pp. 618, 3 figs. Cleworth-Wheel air-humidifying apparatus.

HEATING, ELECTRIC

Ovens and Hot Plates. Some Thermal Characteristics of Electric Ovens and Hot-Plates, Ezer Griffiths, and F. H. Schofield. Jl. Instn. Elec. Engrs., vol. 59, no. 300, April 1921, pp. 361-372, 14 figs. Specifications for conducting tests on cooking ovens.

HOUSES, CONCRETE

Construction Methods. New and Successful Method of Constructing Concrete Houses, D. V. Weed, Jr. Concrete Products, vol. 20, no. 6, June 1921, pp. 13-15, 4 figs. Lamouldette system employing interchangeable light steel forms or units, specially rolled and shaped for maximum strength which may be set up to either vertical or horizontal position and quickly clipped together by ingenious device to form rigid mould into which concrete is poured and structure cast as monolith.

Design. A Concrete House Scheme. Concrete & Constructional Eng., vol. 16, no. 6, June 1921, pp. 353-359, 7 figs. Typical English design.

HOUSING

Industrial. The Calder Report on the Building Situation. U.S. Dept. of Labor, Monthly Labor Rev., vol. 12, no. 6, June 1921, pp. 96-100. Report to U.S. Senate of Select Committee on Reconstruction and Production. Among recommendations is creation of "a bill to establish in Dept. of Commerce a division for the gathering and dissemination of information as to the best construction practices and methods, technical and cost data, and matters relating to city planning, etc., in order to encourage standardization and improved building practices throughout the country."

HYDRAULIC MACHINERY

Manufacture. Building Hydraulic Machinery. Eng. Production, vol. 2, no. 38, June 23, 1921, pp. 749-754, 15 figs. Procedure at representative works.

HYDRAULIC TURBINES

Francis Type. Kern River Three Development has Highest Head Francis Turbines Installed. Power, vol. 53, no. 25, June 21, 1921, pp. 996-999, 5 figs. Two vertical-shaft 22,500 hp. Francis type turbines operating under effective head of 800 ft. Two runners are provided for each unit, one for 50-cycle and one for 60-cycle operation. Water is carried through series of tunnels aggregating 60,000 ft. in length, longest single bore being 7, 132 ft.

HYDROELECTRIC PLANTS

France. Hydroelectric installation on the Arly River (Installation Hydro-électrique de l'Arly), Francis Babey. Electricien, vol. 37, no. 1274, April 15, 1921, pp. 169-174, 8 figs. Development of 800 hp. for metallurgical works.

New England. Rebuilding an Old New England Water-Power Plant, E. H. Swett. Eng. News-Rec., vol. 86, no. 25, June 23, 1921, pp. 1062-1066, 6 figs. Special construction problems in new hydroelectric station for Jackson mills long supplied with power from individual wheels taking water from Nashua River.

Niagara-Falls. Hydroelectric Development at Niagara Falls, John L. Harper and J. A. Johnson. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 7, July 1921, pp. 561-576, 33 figs. Also abstract in Power, vol. 54, no. 1, July 5, 1921, pp. 26-28, 6 figs. Historical survey. Possibility of more efficient utilization of water power available for development according to international treaty, which permits utilization of 20,000 cu. ft. per sec. on American side and 36,000 cu. ft. per sec. on Canadian side.

Northwestern U.S. Electrical Construction Work in Northwestern States, W. A. Scott. Elec. Rev., (Chicago), vol. 79, no. 1, July 2, 1921, pp. 11-12. Expansion and reconstruction of hydroelectric plants.

ICE PLANTS

Brine Tanks. Concrete Brine Tanks, H. C. Boyden. A. S. R. E. Jl., vol. 7, no. 5, Mar. 1921, -pp. 390-400. Advantages of concrete brine tanks. Principles that should be observed in their design.

I

INDICATORS

Internal-Combustion Engines. A Pressure Indicator for Internal-Combustion Engines, J. Okill. Power, vol. 54, no. 1, July 5, 1921, pp. 10-11, 2 figs. Modified form of steam-engine indicator.

INDUSTRIAL MANAGEMENT

Germany. The Taylor System and Scientific Management in Germany (Das Taylor-System und die deutsche Betriebswissenschaft), G. Schlesinger. Werkstattstechnik, vol. 15, no. 11, June 1, 1921, pp. 313-317. Discusses form in which Taylor system and the Gilbreth motion studies can best be adapted to German conditions.

Graphic Methods. The Ratio Chart and Its Application—I, Percy A. Bivins. Indus. Management, vol. 62, no. 1, July 1, 1921, pp. 10-14, 11 figs. Exposition of construction and uses of ration charts.

Personnel. Personnel Management of the Metropolitan Life Insurance Co., Lawrence Washington. Indus. Management, vol. 62, no. 1, July 1, 1921, pp. 27-32, 8 figs.

Production Systems. Analyzing Tool Production Problems, Albert A. Dowd, and Frank W. Curtis. Iron Age, vol. 107, no. 25, June 23, 1921, pp. 1671-1673, 9 figs. Method of analysis. Results of alternative methods of machining and set-up.

Budgeting Business, Park Mathewson. Indus. Management, vol. 61, no. 11, June 1, 1921, pp. 404-407, 3 figs. Planning production quotas by means of budget system.

Graphic Production Control for the Small Shop, R. J. Rahn. Indus. Management, vol. 61, no. 11, June 1, 1921, pp. 432-436, 3 figs. Control sheet.

How and Why Production Methods Increase Shop Production, E. T. Spidy. Jl. Eng. Inst. of Canada, vol. 4, no. 7, July 1921, pp. 404-408, 5 figs. General outline of modern production methods, with particular emphasis on importance of shop schedule.

The Economy of Standard Quantities, Paul E. Holden. Indus. Management, vol. 62, no. 1, July 1, 1921, pp. 34-36, 2 figs. Avoiding too-frequent machine set-ups and unbalanced stocks.

Rate Setting. Serial Rate-Setting, H. P. Losely. Indus. Management, vol. 61, no. 11, June 1, 1921, pp. 409-415, 10 figs. Determining time-rates on varying sizes of similar parts.

Stores Organization. Stores Organization. Eng. Production, vol. 2, no. 38, June 23, 1921, pp. 739-742, 9 figs. Forms for keeping records.

See also Time Study.

INDUSTRY

Developments. Personal Observations in the Industry, Arthur W. Berresford. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 7, July 1921, pp. 555-560. Suggestions in regard to furthering industrial progress.

Selection of Industrial Sites. Choosing the New Plant Location, H. H. McCanna. Indus. Management, vol. 61, no. 11, June 1, 1921, pp. 396-298, 2 figs. Factors affecting selection of industrial sites.

INSPECTION

Managing Department. Managing an Inspection Department, George S. Radford. Indus. Management, vol. 61, no. 11, June 1, 1921, pp. 422-426, 1 fig. How to handle personnel and routine.

Methods. The Delco Inspection System, Louis Rothenberg. Machy. (Lond.), vol. 18, no. 454, June 9, 1921, pp. 289-293, 4 figs. Methods used by Dayton Engineering Laboratories Co. for inspection of raw materials, purchased parts, tools, equipment and gages, and manufactured products.

IRON ALLOYS

Magnetic Properties. On the Influence of Low Temperatures on the Magnetic Properties of Alloys of Iron with Nickel and Manganese, Kamerlingh Onnes, Robert A. Hadfield and H. R. Woltjer. Proc. Royal Soc., vol. 99, no. A698, June 1, 1921, pp. 174-196, 11 figs. Experiments showed that iron manganese alloys, containing higher percentages of manganese, cannot be made magnetic at atmospheric temperature by cooling to boiling point of liquid hydrogen or liquid helium.

IRON CASTINGS

Cleaning. Cleaning and Dressing Castings, F. W. Wilson. Engineering, vol. 111, no. 2893, June 10, 1921, pp. 725-727, 13 figs. Procedure and equipment. Paper read before Manchester Assn. Engrs.

J

JIGS

Design. Tool Engineering, Albert A. Dowd and Frank W. Curtis. Am. Mach., vol. 54, nos. 25 and 26, June 23 and 30, 1921, pp. 1078-1080, 5 figs, and 1119-1122, 7 figs. June 23: Closed jigs for annular and straight holes. Locating and assembling jigs. June 30: Design of drill jigs, indexing and trimming jigs; drilling and reaming indexing fixtures and four-sided jigs for accurate work.

Tool Engineering, Albert A. Dowd and Frank W. Curtis. Am. Mach., vol. 55, no. 1, July 7, 1921, pp. 18-22, 11 figs. Design of drill jigs. Principles and methods of indexing. Index plungers and latches. Combined index and latch. Specific examples of indexing jigs.

L

LABOR

Italy. Labor Unrest in Italy, Alfred Maylander. U. S. Dept. of Labor, Monthly Labor Rev., vol. 12, no. 6, June 1921, pp. 137-259. Role played by labor organization and political bodies in present unrest among industrial and agricultural labor. Extent to which economic causes have operated to bring about labor unrest, and measures that have been taken to abate it. Developments in syndicalist control of industries.

LABORATORIES

Research. The Rudge-Whitworth Research Laboratory, Machy. (Lond.), vol. 18, no. 454, June 9, 1921, pp. 301-303, 5 figs. Measuring instruments developed at research laboratory of Rudge-Whitworth Manufacturers of steel balls, ball bearings, pedal and motorcycles and detachable wire wheels.

LATHE WORK

Time Allowances. Suggestions for turning Operations (Drehakkorder), F. Lohage. Werkstattstechnik, vol. 15, no. 12, June 15, 1921, pp. 355-358, 4 figs. Notes in determination of working time for turning operation, turning spindles and bolts, and cutting threads on lathe. Includes table for determination of working time for cutting Whitworth threads.

LIGNITE

Research. Researches upon Brown Coals and Lignites. Part I—Heat Treatment at Temperatures below 400 deg. C. as a possible Method for Enhancing Their Fuel Values, William A. Bone. Proc. Royal Soc., vol. 99, no. A698, June 1, 1921, pp. 236-251, Treatment was found to improve fuel values of brown coals and ignites.

LOCOMOTIVE BOILERS

Heat Transmission in Flues. Heat Transfer in Flues—A Graphic Method of Calculation, A. J. V. Umanski. Engineering, vol. 111, no. 2893, June 10, 1921, pp. 702-703, 2 figs. Graphs for Computing temperature drop in flues of various diameters.

Canadian Pacific Railway. A Locomotive Designed for Rigorous Operating Conditions, W. H. Winterrowd. Ry. Rev., vol. 68, no. 25, June 18, 1921, pp. 929-936, 14 figs. Pacific type locomotive designed for Canadian Pacific Ry. Characteristics: Cylinder, diameter and stroke, 25 in. by 30 in.; boiler pressure, 200 lb. per sq. in.; diameter drivers, 75 in.; weight engine, total 299,000 lb.; heating surface, total 3529.6 sq. ft.

Consolidation Type. Consolidation Locomotives for the Western Maryland. Ry. Mech. Engr., vol. 95, no. 7, July 1921, pp. 419-422, 8 figs. Characteristics: Cylinders, 27 in. by 32 in.; boiler type, straight top; boiler diameter, 88 in.; working pressure, 210 lb. per sq. in.; tractive effort, 68, 200 lb.; total weight, 294,900 lb.

The New Consolidation Locomotive of the Belgian State Railway (Les nouvelles locomotives "Consolidation" des chemins de fer de l'état belge), M. E. Minsart. Bulletin Technique de l'Association des Ingénieurs sortis de l'Ecole Polytechnique de Bruxelles, vol. 17, no. 2, 1920-1921, pp. 117-127, 3 figs. Manufactured in America. Characteristics: Cylinders, 610 mm. diameter by 711 mm. stroke; interior diameter of boilers, 1727 mm.; heating surface, total, 172.2 sq. in.; super heating, 51.1 sq. m.; total weight in working order 84500 kg.; tractor effort at 65 per cent of boiler pressure, 15,840 kg.

Cutoff Control. The Automatic Control of Locomotive Cutoff, E. S. Pearce. Ry. Age, vol. 70, no. 25, June 24, 1921, pp. 1451-1456, 11 figs. Tests conducted by Big Four Ry.

Driving Wheels. Methods Used in Locomotive Driving Wheels, Axle and Crankpin Work, Frank A. Stanley. Am. Mach., vol. 54, no. 25, June 23, 1921, pp. 1070-1072, 8 figs. Present practice on several classes of work in Southern Pacific shops. Allowance required for shrinking tire on driving wheels.

Feedwater Heating. Developments in Lovomotive Feed Water Heating, Ry. Rev., vol. 69, no. 2, July 9, 1921, pp. 44-46, 3 figs. Refinements in design facilities return of condensate to feed water and elimination of water stops.

Locomotive Feedwater Heating (Die Speisewässervorwärmung im Lokomotivbetriebe), R. Sanzin. Verkehrstechnik, vol. 38, no. 7, Mar. 5, 1921, pp. 85-87. Advantages of feedwater heating. Drummond, Caille-Potonié, Worthington and Knorr systems.

Repairs. Manufacturing Standard Locomotive Repair Parts, M. H. Williams. Ry. Mech. Engr., vol. 95, no. 7, July 1921, pp. 451-455, 7 figs. Method of standardizing and manufacturing locomotive repair parts in central production shops.

LOCOMOTIVES

Shops. Railway Machine Shop Practice—I. Machy. (Lond.), vol. 18, no. 455, June 16, 1921, pp. 312-325, 12 figs. Methods employed in locomotive shops of Great Western Ry. Co., England.

Superheater. Pyrometers Promote Locomotive efficiency. Ry. Mech. Engr., vol. 95, no. 7, July 1921, pp. 433, 2 figs. Tests showing values of pyrometers applied to superheater locomotives.

Valve Gear. Poppet Valve Gear for Steam Locomotives (Ventilsteuerung für Damp flokomotiven), H. Wittfeld. Zeit. des Vereines deutcher Ingenieure, vol. 65, no. 24, June 11, 1921, pp. 623-625, 10 figs. Describes Lentz valve gear which can be installed in existing locomotives in place of piston valves without alteration of cylinder and driving rod. Results of extended experimental operation.

LUBRICATING OILS

Mineral. The Improvement of the Lubricating Properties of Mineral Oils, J. H. Hyde. Engineering, vol. 111, no. 2893, June 10, 1921, pp. 708-709, 10 figs. Improvement of lubricating properties of mineral oils by addition of fatty oils and acids. From experiments conducted at British Nat. Physical Laboratory.

Research. Investigation into Properties of Lubricating Oils. Automotive Industries, vol. 45, no. 1, July 7, 1921, pp. 16-17. Report of tests made by British committee covers measurement of coefficient of friction at various temperatures and with oils of various viscosities. Comparisons of vegetable, animal and mineral oils with and without addition of refined or deflocculated graphite are included.

Tests. Endurance test of Force Feed Oils, J. G. O'Neill. Jl. Am. Soc. of Naval Engrs., vol. 33, no. 2, May 1921, pp. 248-260, 9 figs. It is concluded that mineral lubricating oils, derived from asphaltic base crude or paraffin base crude and of same viscosity at operating temperatures, will give same service in force-freed lubrication system.

M

MACHINE SHOPS

Power-Plant. Power Plant Machine Shops, W. O. Rogers. Power, vol. 54, no. 1, July 5, 1921, pp. 12-19, 26 figs. Machine tools found in use in representative power-plant machine shops.

Railways. Railway Machine Shop Practice—II. Machy. (Lond.), vol. 18, no. 456, June 23, 1921, pp. 349-351, 6 figs. Methods employed in locomotive shops of Great Western Ry. Co., England.

Railway Machine Shop Practice—IV. Machy. (N. Y.), vol. 27, no. 11, July 1921, pp. 1015-1017, 7 figs. Methods used in machining crown brasses, driving-boxes, and shoes and wedges.

MACHINE TOOLS

Drive. Machine-Tool Driving, J. D. Hope. Mech. World, vol. 69, no. 1798, June 17, 1921, pp. 459-460. Individual electric driving arrangements versus group system of driving.

MALLEABLE IRON

Casting. American Malleable Cast Iron—XIII, H. A. Schwartz. Iron Trade Rev., vol. 68, no. 26, June 30, 1921, pp. 1792-1797, 5 figs. Electric furnace melting. Kranz triplex process.

MARINE BOILERS

Manufacture. Marine Boiler Construction—II. Machy. (Lond.), vol. 18, no. 454, June 9, 1921, pp. 295-300, 12 figs. Methods and machines employed in representing English shops.

MARINE ENGINES

Oil. Modern Marine Oil Engines—I. Engineer vol. 131, no. 3416, June 17, 1921, pp. 633-635 and 644, 5 figs. Doxford 3000 i. hp. opposed-piston type.

MEASURING INSTRUMENTS

Internal Measurements. New Light on Internal Measurements, John Bath. Am. Mach., vol. 54, no. 26, June 30, 1921, pp. 1110-1114, 4 figs. Forms of contracts for measuring cylindrical surfaces. Results induced by presence of oil on surfaces in contact.

Pneumercator. The Pneumercator System. Shipbuilding & Shipping Rec., vol. 17, no. 24, June 16, 1921, pp. 745-746, 5 figs. Method of recording height or weight of liquid at distant point.

METEOROLOGY

Weather Forecasting. Weather Forecasting (Le problème de la prévision du temps), L. Dunoyer and G. Reboul. Journal et Physique et le radium, vol. 2, no. 5, May 1921, pp. 129-131, 1 fig. Experience of Meteorological Service of French army.

METRIC SYSTEM

Japan. The Metric System in Japan, J. H. Blakey. Power Plant Eng., vol. 25, no. 13, July 1, 1921, pp. 673. Obligatory adoption of metric system in Japanese empire. Translated from Comptes rendus de l'Académie des Sciences.

MILLING MACHINES

Drum Type. Manufacturing Applications of Ingersoll Drum-Type Milling Machines, J. V. Hunter. Am. Mach., vol. 55, no. 1, July 7, 1921, pp. 23-27, 21 figs. Fixtures for holding work. Automatic clamping devices.

MINERALS

Ore Washing. Notes on the Mechanical Preparation of Minerals (Considérations sur la préparation mécanique des minerais). M. Alexandre Lhéraud. Revue de l'industrie minérale, no. 10. May 15, 1921, pp. 371-398, 14 figs. Ore washing.

MINES

Rock Dumping. Method of Dumping Mine Rock by a Self-Tripping and Self-Closing Bucket Traveling on a Ropeway. Coal Age, vol, 19, no. 25, June 23, 1921, pp. 1116-1117, 1 fig. By raising derrick or tightening rope catenary curve of latter may be so arranged that rock is automatically dumped at any level or place desired.

MINING

Brazil. Brazil as a Mining Country, George A. Packard. Eng. Min. Jl., vol. 112, no. 2, July 9, 1921, pp. 45-52, 7 figs. Region poorly mapped and partly unexplored. Railroad facilities inadequate, waterways being largely used. Morro Velho and Passagem gold mines described. Manganese and iron resources great. Potash, oil shales, diamonds and other precious stones occur.

MOULDING METHODS

Green Sand. Costs Dictate Changes in Molding, Pat. Dwyer. Foundry, vol. 49, no. 13, July 1, 1921, pp. 501-509, 16 figs. Experience of Muncie Foundry & Machine Company, Muncie, Ind. Dry sand has been abandoned in favor of green sand method for molding automobile cylinders.

MOTOR BUSES

Trolley. Electrification at Edinburg. Elec. Ry. Jl., vol. 58, no. 1, July 2, 1921, pp. 12-14. 3 figs. Gasoline motor buses and electric railway cars replace cable operation. Choice was determined by traffic power and price conditions.

Pioneer Trackless Trolley Installation. Elec. R,y. Jl., vol. 57, no. 26,June 25, 1921, pp. 1158-1161, 7 figs. Experimental trol'ey buses operated inconjunction with rail service at Richmond., Va.

MOTOR PLOWS

German. Modern German Motor Plows (Neuere deutsche Motorpfluge), Richard Bussien. Oel-u. Gasmaschine, vol. 18, no, 6, June 1921, pp. 81-96, 21 figs. Details of various types.

MOTOR TRUCK

Leyland Steam Wagon. The Leyland Steam Wagon Engr., vol. 131, no. 3415, June 10, 1921, pp. 616-617, 7 figs. Hydraulic tipping steam wagon manufactured by Leyland Motors, Ltd., Leyland, England.

Manufacture. Fits, Tolerances and Heat Treatments Applied in Production, C.T. Bates. Automobile Industries, vol. 44, no. 24, June 16, 1921, pp. 1314-1326, 9 figs. Data covering actual practice employed by many manufacturers in production of all parts used in heavy truck. Same fits, tolerances and heat treatments are applicable in production of parts for passenger cars, light trucks and other automotive vehicles.

MOTORCYCLES

British. Review of Engineering Features of British Motorcycles, M. W. Bourdon Automotive Industries, vol. 44, no. 25, June 23, 1921, pp. 1376-1381, 6 figs. Types exhibited at Olympia show.

N

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Coal vs. Relative Efficiencies with Coal and Fuel Oil, A. W. Darter. Power Plant Eng., vol. 25, no. 13, July 1, 1921, pp. 657. Comparative boiler tests with Texas lignite and with Mexican fuel oil.

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P

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Analysis. A Method for Differentiating and Estimating Unbleached Sulphite and Sulphate Pulps in Paper, R. E. Lofton and M. F. Merritt. Technologic Papers Bur. Standards, No. 189, April 4, 1921, 18 pp. Method of making quantitative determination of mixtures of unbleached sulphite and sulphate pulps. Basic differences in manufacture of two pulps.

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Rubber. Rubber Paving in London. Eng. News.,Rec., vol. 86, no. 26, June 30, 1921, p. 1120. Experience with rubber pavement on streets carrying heavy traffic.

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Aluminum. Problems and Possibilities of the Aluminum Piston, Walter Rosenhain Auromorive Industries, vol. 44, no. 24, June 16, 1921, pp. 1264-1266 and 1301 Advantages of and limitations of aluminum piston for automobile and aeroplane engines.

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Production System. Production Planing in Machine Tool Plants. Machy. (Lond.) vol. 18, no. 455, June 16, 1921, pp. 326-330, 6 figs. Importance of using adequate number of stops in setting up planer work. Tables of planing speeds and feeds for roughing cuts in various materials.

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FEDERAL-AID PROJECT. Crushed Stone and Gravel Roads, C. L. McKesson and A. F. Morris. Public Roads, vol. 4, no. 1, May 1921, pp. 3-5. Experience in construction of federal-aid project.

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BOLLEN CABLE PULLEY. The Boilen Cable Pulley. Engineering, vol. 111, no. 2895, June 24, 1921, p. 771, 6 figs System built up of two independent wheels and a movable race. When pulley is in operation, pull on cable causes movable race to be forced inward on side at which pressure comes and as a result rims of two wheels close together and grip cable.

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KITCHEN TYPE. The Kitchen Reversible Propeller (Le gouvernail à changement de marque kitchen). Génie Civil, vol. 78, no. 19, May 7, 1921, pp. 396-397, 6 figs. Rudder is surrounded by system of two cylindrical deflectors mounted on common pivots and capable of rotating jointly or separately about rudder.

S

SCIENTIFIC MANAGEMENT

See Industrial Management.

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TOOLS. The Calculation fo Circular Form Tool Diameters Having Top Rake, A. Washington. Machy. (Lond,) . vol 18, no 455 June 16, 1921, pp. 337-338, 3 figs. Formulas.

SCREWS THREADS

CUTTING. The Problem fo Accurate Thread Cutting, B. M. W. Hanson. Machy. (N.Y.), vol. 27, no. 11, July 1921, pp. 1012-1914, 4 ffigs. Requirements to fulfill in fitting threaded parts. Work of engineerin committees is establishing tolerance within so-called cammercial limitations.

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STATISTICS. World Shipbuilding, H. R. McClelland. Jl. Eng. Inst. of Canada, vol. 4, no. 7, July 1921, pp. 389-396, 6 figs. History, ship framing, types of modern steamship, modern ship propulsion. Canada as shipbuilder,

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INTERNAL-COMBUSTION ENGINES. Internal Combustion Engines Applied to Propulsion, John F. Metten and J. C. Shaw. Mar. Eng., vol. 26, no. 7, July 1921, pp. 542-545. Comparative earning capacities of motorships and oil burning steamers. Machinery equipment of motorship William Lenn.

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MERCHANT MARINE. Electric Propulsion for Merchant Marine, Wilfred Sykes. Jl. Western Soc Engrs, vol 26, no 6, June 1921, pp 211-219 Comparative fuel requirements of reciprocating engines, gear turbines, electric drive, direct connected Diesel engines and Diesel-electric drives

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REFRIGERATOR Balsa Insulation for Refrigerator Ships Mar Eng , vol 26, no. 7, July 1921, pp. 557-560, 3 figs Standard insulation plans

RESISTANCE. On the Use of Models in Investigating the Resistance of Ship structures to External Explosions, E. Buckingham Jl Am Soc of Naval Engrs., vol 33, no. 2, May 1921, pp 227-247 Technical considerations.

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SOFT. War experiences with Soft Solders, Hans Schulz Metal Industry (Lond.), vol. 18, no. 23, June 19, 1921, pp. 443-444 Experiments conducted during war by German Naval Dept. on tin-lead, cadmium, Matulot, Thyssen and magnesium solders.

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CONCRETE-ENCASED. Conservation of Corrosion Weakened Stell Stacks by Encasing with Concrete, John V. Schaefer. Eng. & Contracting, vol. 55, no. 25, June 22, 1921, pp. 619-620, 3 figs. Experience South Works of Ill. Steel Co.

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FLOW IN PIPES. Handy Steam Velocity and Steam Flow Tables, V. F. Davis. Mar. Eng., vol. 26, no. 7, July 1921, pp. 522. Capacities of steam pipes in pounds per minute with steam-flow velocity of 6000 ft. per min.

PROPERTIES. The Specific Volume of Dry Steam, M. J. Eichhorn. Power vol. 53, no. 25, June 21, 1921, pp. 1006-1007, 1 fig. Nomogram for specific volume dry steam.

STEAM ELECTRIC PLANTS

GLASGOW, SCOTLAND. The Dalmarnock Power Station, Engineering, vol. 111, nos. 2894 and 2895, June 17 and 24, 1921, pp. 736-738 and 748, 12 figs., and 767-771, 6 figs. June 17: Turbo-alternator, 15,000 Kw. capacity. June 24: Electrical equipment.

STEAM ENGINES

25,000-HP. Three-Cylinder, 25,000-Hp. Steam Engines for Rolling Mill Drive (Machine à vapeur à trois cylindres de 25,000 chevaux pour la commande d'un train de laminoir). Génie Civil, vol. 78, no. 23, June 4, 1921, pp. 469-472, 6 figs. Installation in Middleborough Stell Works, England.

UNIFLOW. New Uniflow Engine Design. Power, vol. 53, no. 26, June 28, 1921, pp. 1042-1043, 4 figs. Equipped with night-lift poppet valves of small diameter, which are opercated from valve shft, geared to run at twice spedd of main engine shaft.

STEAM ROLLERS

MANUFACTURE. Modern Method on Steam Roller Construction. Eng. Production, vol. 11, no. 37, June 10, 1921, pp. 725-729, 13 figs. Interchangeable manufacturing processes at representative works.

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BRITISH THOMSON-HOUSTON. Recent Improvements in Steam Turbine Design—IV, Engr., vol. 131, no. 3414, June 3, 1921, pp. 592-593 and 596, 8 figs. Recent types manufactured by British Thomson-Houston Co.

LUBRICATION. Lubrication of steam Turbines—I. Gen. Elec. Rev., vol. 24, no. 7, July 1921, pp. 651-655. Principles of oil lubrication with special reference to turbine bearings, consideration being given to effect of speed, clearance, cooling by means of oil circulation, viscosity and emulsification.

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See also Balancing.

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ALLOY. *See Alloy Steels.*

COBALT. *See Cobalt Steel.*

FATIGUE. The Fatigue of Steel. Iron Age, vol. 107, no. 25, June 23, 1921, pp. 1687. Progress made in research and in explanation of causes. Paper read before Am. Inst. Min. & Metallurgical Engrs.

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High-Speed Steel. Heat-Treatment of High-Speed Steel Cutting Tools of Intricate Design, A. J. Langhammer. Chem. and Met. Eng., vol. 25, no. 1, July 6, 1921, pp. 30, 3 figs. Comparison of various methods.

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Electric Furnaces. Accounting for Electric Alloy and Tool Steel, G. Harvey Porter. Jl. of Accountancy, vol. 32, no. 1, July 1921, pp. 1-15. Tabulation of control accounts, and method of drawing up details of 14 records.

Processes. Development of Iron Ore Into Iron and Steel, S. C. Dickernoff, Jr. Forging & Heat Treating, vol. 7, no. 6, June 1921, pp. 336-337. Chart indiqating prices.

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Power Generation. Power Generation in Steel Mills and Its Relation to Frequency, D. M. Petty. Assn. Iron & Steel Elec. Engrs., vol. 3, no. 6, June 1921, pp. 199-212, 2 figs. Blast furnace gas power station. Selection of frequency.

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Mechanical. Limitations of Mechanical Stokers. Power Plant Eng., vol. 25, no. 13, July 1, 1921, pp. 674-675. Limitations of mechanical stokers utilizing Mid-West coals.

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Automatic. Automatic Substations Entering Electric Service Field, R. J. Wensley. Elec. World, vol. 78, no. 1, July 2, 1921, pp. 14-15, 4 figs. It is said automatic substation has definitely proved success in industries. Advantage claimed are saving in feeder copper and good service rendered.

Brief Review of Automatic Substation Experience on the Aurora Elgin & Chicago R. R. , S. E. Johnson. Gen. Elec. Rev., vol. 24, no. 7, July 1921, pp. 610-612, 1 fig. Inspection periods are seven days apart and control equipment is adjusted to furnish maximum of power throughout 24 hours.

Efficiency and Operating Tests on the North Shore Automatic Substations, Cassius M. Davis. Gen. Elec. Rev., vol. 24, no. 7, July 1921, pp. 613-619, 4 figs. Machine of three different capacities were tested, including both commutating and non-commutating pole types.

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Steamships. Superheated Steam on Steamships, C. H. Peabody. Mar. Eng., vol. 26, no. 7, July 1921, pp. 539-541, 4 figs. Comparison with locomotive and shore practice. Results with reciprocating engines and Scotch boilers.

SWAGING

Cold. Cold Swaging—II, Machy. (N.Y.), vol. 27, no. 11, July 1921, pp. 1018-1021, 8 figs. Methods employed by Torrington Co., Forrington, Conn. in making swaging dies.

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Caterpillar. Caterpillar Vehicles. Automobile Engr., vol. 11, no. 151, June 1921, pp. 198-200, 5 figs. Recent developments of flexible track schemes.

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Utilization. Economics of Tidal Power Developments (L'utilisation de la houille bleue et le problème financier), R. Goudard. Vie technique et industrielle, vol. 2, no. 31, June 1921, pp. 201-205, 5 figs. Reasons why Government should subsidize tidal-power plants.

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Cylindrical Fits. Tolerance Systems for Cylindrical Fits, P. M. Heldt. Automotive Industries, vol. 44, no. 24, June 16, 1921, pp. 1274-1280 and 1283, 3 figs. Discussion of system in use.

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Rock. Notes on California Rock Tunneling Practice, A. J. Cleary. Eng. News-Rec., vol. 86, no. 25, June 23, 1921, pp. 1082-1085, 5 figs. Tunnel sizes and methods of driving recent improvement in equipment for drilling and mucking, eectric exploders, terms of tunnel contracts.

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Production and Measurement. Methods for the Production and Measurement of High Vacua—IX, Saul Dushman. Gen. Elec. Rev., vol. 24, no. 7, July 1921, pp. 669-680, 7 figs. Physicochemical methods. Theory of phosphorous clean-up in lamps.

VALVES

Emergency. Valves for Emergency Service, W. H. Wakeman. Power, vol. 54, no. 1, July 5, 1921, pp. 7-10, 10 figs. Typical designs.

VIADUCTS

Plate-Girder. Economic Proportions of Plate-Girder Viaducts, H. J. Kesner. Eng. & Contracting, vol. 55, no. 25, June 22, 1921, pp. 607-608, 3 figs. Comparison of three types of approach viaducts. Formulas for determining economic proportions.

VENTILATION

Testing. Testing and Improving Ventilation, Charles L. Hubbard. Power, vol. 53, no. 25, June 21, 1921, pp. 1000-1004, 5 figs. Control of humidity and circulation more important than disposal of carbonic oxide.

W

Washers

Spring. Belleville Spring Washers. Machy. (Lond.), vol. 18, no. 456, June 23, 1921, pp. 354-355, 1 fig. Table giving dimensions of washers of Belleville type to conform with prescribed loads and deflections.

WASTE

Industrial, Disposal of. Disposal of Industrial Wastes and Stream Pollution, C. A. Emerson, Jr. Jl. Franklin Inst., vol. 191, no. 6, June 1921, pp. 807-818, Recent developments and present tendencies.

WATER METERS

Specifications. Standard Specifications for disc Water Meters. Eng. World, vol. 19, no. 1, July 1921, pp. 27-29. Regulations governing design. Information to be furnished to manufacturers when requesting bids. Test for compliance with registration and capacity requirements.

WATER POWER

United Kingdom. Water-Power Developments in the United Kingdom, John B. C. Kershaw. Power, vol. 53, no. 26, June 28, 1921, pp. 1054-1056, 4 figs.

WATER TANKS

Auxiliaries. Auxiliary Equipment for Elevated Water Tanks—I, Charles L. Hubbard. Power Plant Engr., vol. 25, no. 13, July 1, 1921, pp. 647-649, 12 figs. Notes on installation of liquid level indicators and pump controls.

WELDS

Testing. Standardization of Testing Welds, Prov. Instn. Mech. Engrs., no. 4, June 1921, pp. 241-245, and (discussion), pp. 245-288, 12 figs., 3 supp. plates. Elongation data in tensile tests. Standard stress value in fatigue tests. (Concluded.)

Testing Cocered Electrode Process Welds. Boiler Maker, vol. 21, no. 6, June 1921, pp. 161-162. Results of test made to ascertain tensile properties of steel plates welded mid-length in accordance with Kjelberg electric welding system. (Abstract.) From Shipbuilding & Shipping Rec.

WELFARE WORK

Health Department. The Health Service Side of Personnel Management, Earl B. Morgan, S. J. Repplier. Indus. Management, vol. 62, no. 1, July 1, 1921, pp. 43-47, 2 figs. Experience of Curtis Publishing Co.

WELLS

Percolation. Percolation and Tube Wells, Engineering, vol. 111, no. 2894, June 1921, pp. 734-736, 5 figs. Notices on prospecting for water supply from wells.

WOMEN WORKERS

Wages. Wages of Women in Industry, Mary B. Gilson. Indus. Management, vol. 61, no. 11, and vol. 62, no. 1, June 1 and July 1, 1921, pp. 427-431, 4 figs., and 37-42, 4 figs. June: Analysis of conditions in U.S. July: Argument for " full recognition of the justice of equal opportunity" for men and women in industry.

Z

ZINC

Rolling. Pressing and Rolling Zinc, W. Schulte. Metal Industry (Lond.), vol. 18, no. 25, June 24, 1921, pp. 490-491, Machinery and procedure. Translated from "Die Metallborse".

Engineering Index

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A

AEROPLANE PROPELLERS

Theory. General Theory of Aeroplane Propellers (Théorie Générale de l'Hélice Propulsive), A. Rateau, M. R. Soreau and M. S. Drzewiecki. L'Aérophile, vol. 29, nos. 9-10, May 1-15, 1921, pp. 139-146, 7 figs. Development of formulas and comparison with experimental results.

AEROPLANES

Balancing. Aeroplane Balance. L. Huguet. Aerial Age, vol. 13, no. 18, July 11, 1921, pp. 417-419, 1 fig. Influence of wing profile and of passive resistance; influence of steering mechanism; sensitiveness of aeroplane to action of steering mechanism; equilibrium of forces. (Concluded.) Translated from "La Vie Technique & Industrielle."

Horsepower Chart. Aeroplane Flight Endurance—I Aerial Age Weekly, vol. 13, no. 21, August 1, 1921, pp. 490-491, 1 fig. Describes a chart for determining minimum horsepower required or maximum horsepower available at any altitude possible for the aeroplane to reach.

AIRSHIPS

Rigid. Rigid Airships, J. L. Bartlett. Aeronautical Jl., vol. 25, no. 127, July 1921, pp. 357-377, 8 figs. Two lectures, first dealing with general aerostatical principles governing flight of lighter-than air craft, and describing various types of airships, with special reference to rigid airships; second referring to some important problems in design of rigid airship. Appendices.

ALIGNMENT CHARTS

Advantages. Note on Some Useful Alignment Charts. J. A. P. Gibb. Bul. Instn. Min. & Metallurgy, no. 200, May, 1921, pp. 1-11, 6 figs. on supp. plates. Notes and charts presented with object of drawing attention to advantages which alignment charts offer as compared with the more commonly used intercept and correlation charts.

Uses. Alignment Charts—XIV, Arnold A. Arnold. Mech. World, vol. 70, no. 1880, July 1, 1921, pp 9-10, 1 fig. Practical example; marine-engine shafts and crankshafts. Principal proportions of chart. Connection between charts. Concluded.

ALLOYS

See Aluminum Alloys; Bearing Metals; Monel Metal.

ALUMINUM

Exposition, Paris. Exposition of New Industrial Application of Aluminum, Magnesium, Calcium and Sodium at the Société d'Encouragement, Paris (L'Exposition des Nouvelles Applications industrielles de l'Aluminium, du Magnésium, du Calcium et de Sodium, à la Société d'Encouragement pour l'Industrie Nationale). Le Génie Civil, vol. 79, no. 2, July 9, 1921, pp. 36-39. Particulars of program of exposition and reports of four lectures on aluminum and its alloys.

Properties and Uses. Aluminum, Magnesium, Calcium and Sodium (L'aluminium, le magnésium, le calcium et le sodium). Revue Générale de l'électricité, vol 10, no 1, July 2, 1921, pp. 21-29. Report of eight lectures given at the recent exposition on the properties and uses of these metals and their alloys.

ALUMINUM ALLOYS

Melting. Constitution of Gas Atmospheres in Aluminum-Alloy Melting Furnaces. Robert J. Anderson and J. H. Capps. Chem. & Metallurgical Eng., vol. 25, no. 2, July 13, 1921, pp. 54-60, 7 figs. Tabulated analyses of atmospheres of various types of aluminum furnaces, sampled at short intervals during operation, furnishing data necessary for study of dross and metal losses due to furnace operation.

Iron-Pot Melting Practice for Aluminum Alloys, Robert J. Anderson. Metal Industry (Lond.), vol. 19, nos. 1 and 4, July 1 and 22, 1921, pp. 8-9 and 65-66. Present-day methods and detailed investigations of them in practice. See also Metal Industry (New York), vol. 19, no. 7, July 1921, pp. 285-287, 4 figs.

AMMONIA

Coke-Oven Gas as Source. Increasing the Ammonia Yield with the Distillation of Anthracite (Beiträge zur Erhöhung der Ammoniakausbeute bei der Destillation der Steinkohle). Friedrich Sommer. Stahl u. Eisen, vol. 41, no. 25, June 23, 1921, pp. 852-859, 5 figs. Process for recovery of hydrocyanic acid contained in coke-oven gas through conversion into ammonium sulphate.

ASBESTOS

Arizona. Asbestos. University of Ariz. Bul., no. 113, series no. 24, June 1, 1921, 31 pp., 3 figs., 2 on supp. plate. Deals with most important asbestos minerals; geological occurrence; grades and specifications; uses; demand and market value; production; mining and treatment; etc.

AUTOMOBILE ENGINES

Fuel Economy. Effect on fuel Economy of Refinements in Engine Design, L. Mantell. tell. Automotive Ind., vol. 45, no. 4, July 28, 1921, pp. 161-167, 9 figs. Discusses factors of design which affect performance and economy, such as pulsating flow, valve timing, scavenging, etc.

Localized Charge and Supercharging. Experiments with Localized Charge and Supercharging Engines, Harry R. Ricardo. Automotive Industries, vol. 45, no. 2, July 14, 1921, pp. 61-68, 18 figs. Report of investigations demonstrating how mean effective pressure and economy can both be increased by use of stratified charge. Excess air and cooled exhaust gas are employed as diluents to limit maximum temperature of cycle and prevent detonation. Unusually high fuel economy at part load is obtained by use of nonthrottling engine. (Abstract.) Paper presented before (British) Instn. Automobile Engrs.

AUTOMOBILE FUELS

Efficient Utilization. More Miles per Gallon, O. C. Berry. Chem. & Metallurgical Eng., vo. 25, no. 2, July 13, 1921, pp. 64-68, 4 figs. Discussion on carburetion as affecting motor efficiency, brake horsepower and work. Spark timimg and brake load. Relation between torque and engine speed. Possibilities of more efficient utilization of motor fuels. Paper read at Automotive Symposium, Am. Inst. Chem. Engrs.

See also Gasoline

AUTOMOBILES

European vs. American Practice. Comparison of European and American Automobile Practice. Jl. Soc. Automotive Engrs., vol. 9, no. 2, August 1921, pp. 109-115 and Discussion 115-117. Comparison of general design, road conditions, etc.

Rolls-Royce. Some Unusual Features of the Rolls-Royce Car, Fred H. Colvin. Am. Mach., vol. 55, no. 3, July 21, 1921, pp. 85-86, 7 figs. Power transmitted through large ball joint. Bracing used at rear end of chassis. Axle and torque tubes made of steel forgings.

Transmission Cases. Machining and Inspecting Transmission Cases, Fred H. Colvin. Am. Mach., vol. 55, no. 4, July 28, 1921, pp. 143-147. 23 figs. Fixtures hold aluminum cases without springing. Drilling and tapping operations. Inspection gages that insure accurate alignment.

AVIATION

Aerial Transportation. Value of Airplanes in Transportation (De la Valeur de l'Avion Comme Engin de Transport), L. Hirschauer. L'Aéronautique, vol. 3, no. 25, June 1921, pp. 255-258, 2 figs. Discusses security, regularity, speed, stops, etc. (To be continued.)

Commercial. Commercial Aviation in Germany, Erik Hildesheim. Aviation, vol. 11, no. 5, August 1, 1921, pp. 135-136, 1 fig. Considers Conditions of subsidy planes under construction, air transport service and passenger rates.

Luminous Beacons. Luminous Beacons on Aerial Routes for Nocturnal Flying (Le balisage lumineux des routes aériennes pour la navigation nocturne). Le Génie Civil, vol. 79, no. 5, July 30, 1921, pp. 111-112, 2 figs. (From l'Aérophile). Discusses lighthouses with fixed and intermittent light signals.

AXLES

Machinifg Methods. Machining Front Axles. Eng. Production, vol. 3, no. 40, July 7, 1921, pp. 4-6, 7 figs. Methods employed for intensive production.

B

BEAMS

Reinforced-Concrete. Reinforced-concrete Beams—II, T. C. Broom. Mech. Wld., vol. 70, no. 1803, July 22, 1921 pp.68-69. Discusses rectangular concrete beam with double reinforcement. (To be continued.)

Strength of the Reinforced Thin-plate Beam, Held at Its Ends, ans Subject to a Uniformly Distributed Load—Special Case, B. C. Laws. London, Edenburgh and Dublin. Phil. Mag & Jl. of sci., vol. 42, no. 248, 6th series, August 1921, pp 281-287, 3 figs. Continuation of a mathematical investigation started in a previous paper.

BEARING METALS

Properties at High Temperatures. Properties of White Metal Bearing Alloys At Elevated Temperatures, John R. Freeman Jr. and R. W. Woodward, Raw Material, vol. 4, no. 7, July 1921, pp. 241-245, 7 figs. Describes tests carried out by the Bureau of Standards on five alloys.

BELTING

Balata. Balata and Fabric Belt Formulas and Chart, W. F. Schaphorst. Power Plant, Eng., vol. 25, no. 15, August 1, 1921, pp. 769-770.

Rubber. Revised Rubber Belt Specifications Adopted by A.S.T.M. Belting vol. 19, no. 1, July 1921, pp. 13-14, 1 fig. Principal changes provide for increase in allowable stretch from 5 to 6 per cent and reduction of ultimate strength from 285 to 260 lb. Revised specification submitted by Am. Soc. Testing Materials.

BLAST FURNACES

Electric. The Metallurgy of Electric Blast Furnaces (Ueber die Metallurgie des Elektrohochofens), R. Durrer. Stahl U. Eisen, vol. 41, no. 22, June 2, 1921, pp. 753-757, 1 fig. Discussion of certain metallurgical phenomena in electric blast furnaces witb special regards to work of Bo Kalling (see Jernkontorets Annaler, 1919, pp. 413-430) dealing with hot and cold working; part played by direct and indirect reduction in total reduction.

BOILER TUBES

Charcoal Iron. The Manufacture of Charcoal Iron Boiler Tubes. Boiler Maker, vol. 21, no. 7, July 1921, pp. 187-190, and 212, 9 figs. Methods and machines employed by Parkesburg Iron Co.

BOILERS

Accessories. Boiler Accessories from a Safety View Point Power House, vol 14, no. 14, July 20th, 1921, pp 28-31. Discusses various mountings of the modern boiler and makes suggestions for greater safety.

Code Rulings, Pennsylvania. Boiler Code Rulings of Pennsylvania Board. Boiler Maker, vol. 21, no. 7, July 1921, pp. 196-197. Use of autogenous welding in boilers outlined. Inspection and standard stamping of boilers. Rulings adopted May 24, 1921, by Industrial Board, Dept. of Labor and Industry, Pa.

Combustion and Efficiency. Theory of Combustion and Efficiency on Steam Boilers, Arthur R. Norris. Practical Engr., vol. 63, no. 1792, June 30, 1921, pp. 412-413. Gives empirical formula for calculation of calorific value of any fuel when chemical composition is known. Calculation of loss of heat in boilers.

Inspection. Inspecting the Boiler, W. M. McNeil. Power Plant Eng., vol. 25, no. 15, 1921, pp. 752-753. What to look for and where to look for it.

Losses. Minimizing Steam Boiler Losses—III, Robert June. Gas Age, vol. 48, no. 1, July 11, 1921, pp. 7-9. Notes on steam-power management.

Season Cracking. The Season Cracking of Brass and Other Copper Alloys, H. Moore. Engineering, vol. 112, no. 2902, August 12, 1921, pp. 262-264, 9 figs. Results of investigations of season cracking carried during period of some years by Research Department, Woolwich, England. (Abstract.) Paper read before Inst. Metals. (To be continued.)

BRIDGE DESIGN

Eyebar Heads, Stresses in. A study of Stresses in Eyebar Heads, Josef Beke. Eng. News-Rec., vol. 87, no. 6, Aug. 11, 1921, pp. 234-238, 6 figs. Conclusions from Hungarian tests of model eyebars. Excessive stretch of eyebars heads. Permanent set in Budapest suspension bridge chains. Analysis reveals high stresses. Influence of pin diameter

BRIDGE, RAILWAY

American vs European Construction. Railway Bridge Construction and Service by American and European Standards, P. H. Chen. Eng. News-Rec., vol. 87, no. 2, July 14, 1921, pp. 58-59, 3 figs. Higher unit stresses used by European designers. Soft versus hard metal. Rigidity and heavy bracing of American practice. A comparative impact test with European and American locomotives.

Maintenance of Superstructures. Tbe Classification and Maintenance of Old Railroad Bridges, C. F. Loweth. Jl. Western Soc. Engrs., vol. 26, no. 7, July 1921, pp. 248-258, 5 figs. Deals with problems pertaining to determination of strength of existing railroad br dge superstructures.

Reconstruction The Alleghany Railway Bridge. Ry. Engr., vol. 42, no. 498, July 1921, pp. 265-267, 6 figs. Short description of reconstruction of important railway bridge over Alleghany River at Pittsburgh.

BRONZE

Manganese. Methods of Casting Manganese-Bronze Test Bars as a Check on Melts of Small Castings, E. H. Dix, Jr. Metal Ind., vol. 19, no. 8, August 1921, pp. 315-317, 2 figs. Results of experiments made to fix upon a satisfactory method.

BUILDING CONSTRUCTION

Bush Building' london. Construction Features in the Bush Buildings, London. Am. Architect, vol. 120, no. 2372, July 20, 1921, pp. 53-60, 12 figs. 30,000 cu. yd. of earth were excavated for foundations and basement. Details of sidewalk vaults, walls and footings, steel framing, etc.

BUILDINGS

Acoustics. Acoustical Properties of Buildings, F. R. Watson. Jl. Western Soc. Engrs., vol. 26, no. 7, July 1921, pp. 241-247, 3 figs. It is shown that one important problems in acoustics of buildings lies in sound proofing of various rooms.

Office. Fire Resistive Construction of Office Buildings, Fire & Water Eng., vol. 70, no. 4, July 27, 1921, pp. 154-155, 163 and 169. Report of Nat. Fire Prot. Assoc. Committee on building construction.

Steel-Frame. Reducing the Cost of Steel-Frame Buildings, R. Fleming. Eng. & Contracting, vol 56, no. 4, July 27, 1921, pp. 83-86. Considers the questions o design, specifications and standardization in this connection.

C

CABLES

Aerial. Suspension Cables and Their Use in Construction (Les Cables de Suspension et leur emploi dans la Construction). Le Génie Civil, vol. 79, no. 3, July 16, 1921, pp. 59-63, 11 figs. Describes the manufacture of cables and gives illustrations of their application.

CABLES, ELECTRIC

Underground. Industrial Underground Cables, W. B. DeMuth. Power Plant Eng., vol. 25, no. 15, August 1, 1921, pp. 758-759, 2 figs. Factors affecting reliability and heat dissipation; survey of system.

CALORIMETERS

Simmance Recording. Fifth Report of the Research Sub-Committee on the Gas Investigation Committee of the Institution of Gas Engineers. Gas Jl., vol. 154, nos 3032, 3033, June 22, and 29, 1921. pp. 677-684, and 744-750 and vol. 155, no. 3034 and 3035, July 6, and 13, 1921, pp. 35-40 and 101-103, 22 figs. The Simmance recording calorimeter.

Solid Fuel. The Calorimetry of Solid Fuel—II. Eng. & Indus. Management. vol. 5, no. 26, June 30, 1921, pp.737-739, 3 figs. Operating method of some of best-known solid fuel calorimeters are explained and explanitory diagrams are given.

CANALS

Boat Lifts. Boat Lifts in the Canal du Centre (Les Ascenseurs Pour Bateaux du Canal du Centre), L. Van Wetter. Annales des Travaux Publics de Belgique, vol. 22, series 2, June 1921, pp. 445-457, 5 figs. Particulars of construction, operation, cost.

CAR LIGHTING

Testing. Principles of Car Lighting by Electricity—XII, Charles W. T. Stuart. Ry. Elec. Engr., vol. 12, no. 7, July 1921, pp. 278-282, 7 figs. Testing and adjusting a car-lighting equipment.

CAR WHEELS

Failures. Studies Failures of Cast-Iron Wheels, H. J. Force. Foundry, vol. 49, no. 15, August 1, 1921, pp. 602-603. Limits recommended for composition of metal based on analyses of failures.

CARBURETORS

Fundamentals. Fundamental Points of Carburetor Action, F. C. Mock. Jl. Soc. Automotive Engrs., vol. 9, no. 2, August 1921, pp. 85-91, 11 figs. Considers the joint responsibility of the engine designer and the carburetor engineer, and of the latter to produce an instrument that will deliver reliably and consistently a fuel charge with as favorable vaporization conditions as can be obtained.

CARS

All-Metal. New All-Metal Cars in Use on English Railway, F. C. Coleman. Elec. Traction, vol. 17, no. 7, July 1921, pp. 468-470, 3 figs. Cars built by Lancashire & Yorkshire Ry. Details of electrical equipment; automatic control; brake equipment; and interior construction.

All-Steel High-Capacity. New All-Steel Wagons for Bengal-Nagpur Railway. Ry. Engr., vol. 42, no. 498, July 1921, pp. 273-275, 4 figs. Details of high-capacity wagons constructed by Midland Ry. Carriage & Wagon Co., Ltd., Birmingham, for India. Dimensions: Extreme lenght over buffers, 49 ft. 2 in.; width over underframe solebars, 9 ft. 6 in.; center of bogies, 32 ft.; bogie wheelbase, 6 ft.; buffer height, 3 ft. 7½ in.; load, 40 tons.

Dining. New Dining and Kitchen Carriages Built at Derby for the Midland and Glasgow & South Western Railways' Joint Services. Ry. Gaz., vol. 35, no. 3, July 15, 1921, pp. 128-137, 12 figs. 1 supp. pl. Particulars of dimensions and equipment.

Suspension Method. Study of New Suspension Method for Railway Cars. (Etude d'une nouvelle Suspension pour Matériel Roulant), M. Lotte. L'Industrie des Tramways, vol. 15, no. 171-172, March-April 1921, pp. 51-53, 1 fig. (Concluded.)

CARS FREIGHT

Design. Factors to Be Considered in Freight Car Designing, Albert H. Lake, Jr. Ry. Mech. Engr., vol. 95, no. 8, August 1921, pp. 495-496. Arranging details to reduce cost of construction and maintenance and avoiding troublesome defects.

Draft-Gear Tests. Draft-Gear Tests of the Railroad Administration. Ry. Mech. Engr., vol. 95, no. 8, August 1921, pp. 497-501, 8 figs. Results of car impact tests, comparative grading of gears and general conclusions.

CASE-HARDENING

High-Temperature Resisting Alloys. High Temperature Resisting Alloys for Carbonizing, A. Bensel, Trans. Am. Soc. Steel Treating, vol. 1, no. 10, July 1921, pp. 598-601. Sets forth desirability of good heat-resisting containers, and discusses standard methods of case hardening employing these containers, namely, pack, liquid bath and gas carbonizing.

CAST IRON

Shrinkage and Piping. The Shrinkage and Piping of Cast-Iron (Schwinden und Lunkern des Eisens), Karl Sipp. Stahl u Eisen, vol. 41, no. 26, June 30, 1921, pp. 888-890, 2 figs. Supplement to author's article in same journal (Apr. 24, 1921, pp. 675-680), in which theory of shrinkage and piping was developed.

Spiegeleisen, Influence of. Influence of Speigeleisen and Phosphorus Spiegeleisen on Cast Iron (Einfluss von Spiegel-bzw. Phosphorspiegeleisen auf das Gusseisen), E. Schultz. Giesserei-Zeitung, vol. 18, nos. 10 and 12, May 15 and June 15, 1921, pp. 152-155 and 197-200, 3 figs. Based on operating experiences in the Luise Mine in Lünen, Germany. writer explains effect of increase in content of manganese in charge in connection with melting in cupolas caused by addition of spiegeleisen and. phosphorus spiegelseisen. Address delivered before Assn. German Steel Works Engrs.

CASTINGS

Cracks, Annular. Annular Cracks, R. R. Clarke. Metal Industry (Lond.), vol. 19, no. 1, July 1, 1921, pp. 2-3, 10 figs. Discussion of various theories accounting for their formation.

CEMENT

Hardening. Law of Hardening of Cement. (Loi de durcissement du Ciment), J. Bied and E. Garnier. Revue de l'Ingénieur, vol. 28, no. 6, June 1921, pp. 269-272, 1 fig. Graph constructed from results of experiments.

Electric Furnaces, in. Slag Cement Manufacture in Electric Furnaces. Engineering, vol. 112, no. 2898, July 15, 1921, pp. 103-104. Refers to experiments being carried on in Sweden with process of K. G. Wennerström, according to which slag is melted in cylindrical furnace lined inside with carbon or graphite.

Rapid-Setting. Rapid-Setting Cement (Béton à pris accélérée des fermes du Comptoir suisse d'Echantillons de Beaulieu), A. Paris. Bulletin Technique de la Suisse Romande, vol. 47, no. 15, July 23, 1921, pp. 169-172, 7 figs. Results of tests carried out with Holderbank cement to produce a cement which will harden in ten days instead of the usual 28.

Tests. Tests for the Determination of the Variations of Volume of Cement and Cement Mortar During Setting (Versuche zur Ermittlung der Raumänderungen von Zement und Zementmortel beim Abbinden, Etc. Otto Graf. Beton u. Eisen, vol. 20, nos. 4-5 and 6, Mar. 7, and Apr. 4, 1921, pp. 49-52 and 72-74, 12 figs. Influence of water addition, mixture ratio, and cement on extent of volume variations. Measurement of change of length of reinforcement with setting of cement mortar. Investigations of the swelling and contracting of natural stones with moisture and by drying.

CEMENT, PORTLAND

Crushing Plant. Perfect Dry-Mix Control. Rock Products, vol. 24, no. 15, July 1921, pp. 20-28, 29 figs. Details of new crushing plant of Giant Portland Cement Co. at Egypt, Pa.

Coal-Fired. The Economic Limits of Distribution from Coal-fired Stations, William B. Woodhouse. Engineering, vol. 112, no. 2898, July 15, 1921, p. 128, 1 fig. Consideration of steps to be taken to supply an area which extends beyond economical limits of distribution pressure in use. Paper read before Instn. Civ. Engrs.

Equipment. Modern Tendencies in Central Station Construction (Les Tendances Modernes dans la Construction des Centrales), F. Scoumanne. Revue Universelle des Mines, vol. 9, no. 4, May 15, 1921, pp. 346-355. Describes machinery and switchboard equipment.

CHIMNEYS

Brick, Loss of Heat in. Loss of Heat in Brick Chimneys, Alfred Cotton. Power Plant Eng., vol. 25, no. 15, August 1, 1921, pp. 747-748. An investigation into the effect of air infiltration on heat loss.

CITY PLANNING

Principles. Principles of City Planning Stated in a Report for Joliet, Ill. Eng. & Contr., vol. 56, no. 5, August 3, 1921, pp. 108-113. Steps taken to carry out the plan proposed. Discusses street system, carline streets, street widening, zones and their relationship, water transportation and power, park projects, markets, etc.

Roadway and Sidewalk Widths. Roadway and Sidewalk Widths. Good Roads, vol. 61, no. 2, July 13, 1921, pp. 15-18 and 24, 1 fig. Discussion of theory and derivation of formulas; bearing on city planning. Report of Nat. Committee on Widths of Roadways and Sidewalks in Municipalities presented before Nat. Highway Traffic Assn.

COAL

Volatile Content. Determination of Volatile Matter in Coal (Determination de la Teneur en Matières Volatiles), Auguste Dessemond. Revue de l'Industrie Minérale, no. 13, July 1, 1921, pp. 451-456. Develops a formula for calculating volatile matter from ash content.

Volatile Matter in Coal (Les Matières Volatiles de la Houille), Achille Delclève. Chimie & Industrie, vol. 6, no. 1, July 1921, pp. 33-40, 5 figs. Shows that present methods require revision.

Cleaning. Recent Developments in Coal-Cleaning Processes, Robert Nelson. Eng. & Ind. Management, vol. 6, no. 3, July 21, 1921, pp. 72-73. Discusses cleaning of fine and nut coal, percentage of dirt, flotation.

Economic Selection. Factors in the Economic Selection of Coal, A. L. Booth. Coal Ind., vol. 4, no. 7, July 1921, pp. 347-350. Applying the microscope to the study of coal.

Spontaneous Combustion. Spontaneous Combustion of Coal in Mines (Cont.), Richard Kirkby. Colliery Guardian, vol. 122, no. 3159, July 15, 1921, pp. 171-172. Continuation of evidence before British Departmental Committee. (To be continued).

COAL HANDLING

Plant. A Modern Coal Handling Plant. Managing Engr., vol. 8, no. 3, July 1921, pp. 47-52, 6 figs. Describe a mechanical coal-handling plant that involves avoidance of waste and will operate day and night, so long as the necessary driving power is available.

Pneumatic. Plant. The Pneumatic Handling of Coal. Elecn., vol. 86, no. 2249, June 24, 1921, pp. 801-803, 4 figs. Describes pneumatic plant for discharging coal from barges, constructed by Henty Simon, Ltd.

COAL DUST

Inflammability. Six Series of Tests on the Inflammability of Coal Dusts Sixième série d'Essais sur les inflammations de poussières), J. Taffanel. Annales des Mines, vol. 11, no. 6, 1921, pp. 429-543, 3 figs. Carried out at Lievin Testing Station. Considers influence of composition of coal, quantity and fineness of dust, firedamp, initial explosion, etc.

COAL MINING

Hydraulic Stowing. Hydraulic Stowing at Lochhead Colliery. Iron & Coal Trades Rev., vol. 103, no. 2783, July 1, 1921, p. 7. Details of method employed practised at Lochhead colliery. England.

Room-and-Pillar Method. Nova Scotia Steel & Coal Co. Is Completely Removing Coal Seam Under Ten Square Miles of Sea Area, A. S. McNeil. Coal Age, vol. 20, no. 6, August 11, 1921, pp. 205-209, 5 figs. Uses room-and-pillar methods. Engine plane about 10,000 feet long.

COAL STORAGE

Submerging in Pits. Concrete Pits for Submerging Reserve Coal Supply. Elec., Rev., vol. 79, no. 5, July 30, 1921, pp. 163-164, 2 figs. Dangers of spontaneous combustion are eliminated and drippage basin is provided by means of which screenings are saved.

COAL WASHING

Modern Processes. Recent Developments in Coal-Cleaning Processes, Robert Nelson. Engineering, vol. 112, no. 2897, July 8, 1921, pp. 76-77. Describes two processes of recent development, one dealing with cleaning of fines and other with coals of all sizes from 2½ in. downwards. Paper read before Instn. Civ. Engrs.

COKE

Foundry Slag and, Characteristics of. Characteristics of Foundry Cokes and Slags, V. A. Dyer. Iron Age, vol. 108, no. 7, Aug. 18, 1921, pp. 407-409, Analyses, units of value and tests. Analyses and value of fluxes. Slagging. Nature of slags and value of melting process.

COKE BREEZE

Boiler Fuel. Coke Breeze Mixtures for Steaming —II, John Blizzard and James Neil. Coal Trade Jl., vol. 52, no. 29, July 20, 1921, pp. 845-846, 2 figs. Tests show advantages of combining breeze with bituminous coal under hand-fired boilers.

Burning Coke Breeze with Mechanical Stokers, William H. Burton. Coal Industry, vol. 4, no 7, July 1921, pp. 331-333. Successful handling of low-grade fuels in a boiler plant.

COKE-OVEN GAS

Benzol in. Determination of Benzol in Coke-Oven Gas, A. Thau. Part I. Blast Furnace & Steel Plant, vol. 9, no. 8, August 1921. pp. 474-476, 1 fig. Describes European methods of determining benzol. (To be continued).

COLUMNS

Design. Calculation of Columns (Le Calcul des Colonnes), L. Lemaire. Annales des Travaux Publics de Belgique, vol. 22, series 2, June 1921, pp. 367-384, 12 figs. Develops formulas for wind pressures. (To be continued.)

Fire-Resistance Tests. Fire Resistance of Building Columns as Shown by Test, R. E. Wilson. Eng. News-Rec., vol. 87, nos. 3 and 4, July 21 and 28, 1921, pp. 106-110 and 145-146, 5 figs. Conclusions drawn from test series of 106 columns carried out during 1917-18 show cast iron and timber resist longer than unprotected steel. How various fireproofing materials fail. Concrete makes best showing.

COMBUSTION

Alignment Charts for Fuel. Calculating Charts for the Combustion of A Given Fuel (Rechentafeln für die Verbrennung beliebiger Brennstoffe), Wa. Ostwald. Feuerungstechnik, vol. 9, no. 19, July 1, 1921, pp. 173-177, 9 figs. Writer develops a universal alignment chart which can be used directly for every fuel, or from which special charts can be plotted.

Control. Report of the Exposition of Combustion-Controlling Devices (Compte Rendu de l'Exposition des Appareils de Contrôle de la Chauffe), P. Frion. Société des Ingénieurs Civils de France, vol. 74, nos 1, 2, 3, January-March 1921, pp. 7-34, 21 figs. Covers manometers, flow meters, feedwater meters, thermometers and pyrometers, flue-gas analysis, calorific power of coal, etc.

CONCRETE

Age, Effect of. Effect of Age on the Strength of Concrete, Duff A. Abrams. Concrete, vol. 19, no. 1, July 1921, pp. 14-15, 2 figs. Based on careful study of available dats, writer states with utmost confidence that under normal conditions, concrete in roads does not deteriorate in strength with age.

Aggregates. A Study of the Composition of Blast-Furnace Slags Suitable for Concrete Aggregate' L. G. Carmick. Eng. & Contracting, vol. 56, no. 4, July 27, 1921, pp. 82-83, 2 figs. Describes tests made for the purpose.

Crusher Screenings, Effect of. Effect of Crusher Screenings in Concrete, Walter C. Adams and James G. Ross. Cement News, vol. 33, no. 7, July 1921, pp. 19-21, 1 fig. Increase in strength of concrete through use of up to 20 per cent of crusher screennigs in aggregate. Economicadvantage of utilizing screenings. Report on tests carried out by Miton Hersey Co., Ltd., Montreal.

Elasticity ,Modulus of. The Modulus of Elasticity on Concrete, F. C. Lea. Concrete & Constructional Eng., vol. 16, no. 7, July 1921, pp. 435-349 and (discussion) pp. 439-441, 2 figs. Results from compressometer tests show that mixtures in which ratio of sand to stone are 1:1 and 1:1 — are not to be recommended, but only mixtures with ratio of 1:2, properties of which are summarized. (Abstract.)

Proportioning. Proportioning Concrete By Voids in the Mortar, Arthur N. Talbot. Eng. News-Rec., vol. 87, no. 4, July 28, 1921, pp. 147-152, 8 figs. Proposed method of estimating density and strength of concrete and of proportioning materials by experimental and analytical consideration of voids in mortar and concrete. (Abstract.) Paper presented before Am. Soc. for Testing Materials.

Three Methods of Proportioning Concrete. Eng. & Contracting, vol. 56, no. 4, July 27, 1921, pp. 87-91. 12 figs. Discusses Abram's Water-Cement-Radio Strength Relation, Edward's Surface Area Method of Proportioning, Hydro-Electric Power Method of Proportioning, Hydro-Electric Power Commission Method of Proportioning.

Setting Time. Time of Set of Concrete, Watson Davis. Eng. & Contracting, vol. 56, no. 4, July 27, 1921, pp. 79-81. Considers the influence of character of cement, also time and temperature, flowset method, etc.

Specifications. Joint Committee's Tentative Concrete Specifications. Eng. News-Rec., vol. 86, no. 2, July 14, 1921, pp. 68-71. Prepared by Joint Committee on Standard Specifications for Concrete and Reinforced Concrete, and submitted to five contributing societies.

Waterproofing. Waterproofing Concrete—III, J, H. Burgess. Commonwealth Engr., vol. 8, no. 10, May 1, 1921, pp. 306-307. Notes on permeability tests. (Concluded.)

CONCRETE CONSTRUCTION, REINFORCED

Wharves and Breakwaters. Reinforced Concrete for Wharves and Breakwaters, Gerald FitzGibbon. Engineering, vol. 112, no. 2897, July 8, 1921, p. 73. Discusses possible advantages of caisson method of construction for deep-water wharves and breakwaters, both as regards economy in cost and time of construction. (Abstract.) Paper read before Instn. Civ. Engrs.

CONCRETE, REINFORCED

Design. Suggestions for Concrete Design, Harold A. Axtell. Can. Engr., vol. 40, no. 26, June 30, 1921, pp. 1 and 5, 2 figs. Types of live loads for different buildings. Standardization of design. Three systems of slab design and their relative cost.

Deterioration. Reasons for the Deterioration of Reinforced-Concrete Structures Above Mean Tide Level, Leopold Halliday Saville. Engineering, vol. 112, no. 2897, July 8, 1921, pp. 73-74. Theories are presented. Paper read before Instn. Civ. Engrs.

CONCRETING

Chuting Plants. Concrete Chuting Plants. Eng. News-Rec., vol. 87, no. 7, August 18, 1921, pp. 280-283, 5 figs. Notes on best methods of erecting, operating and maintaining concrete chuting plants.

Tunnel Lining. Tunnel Concrete Lining Placed by Pneumatic Gun, W. D. Shannon. Eng. News-Rec., vol. 87, no. 1, July 7, 1921, pp. 14-15, 5 figs. Nearly two miles of 10-ft. pressure tunnel at Caribou hydroelectric plant in California placed by concrete gun known as pneumatic concrete ram.

CONDENSERS, STEAM

Cleaning Tubes. Cleaning Surface Condenser Tubes D. W. R. Morgan. Elec. Jl., vol. 18, no. 7, July 1921, pp. 313-315, 7 figs. Discusses eight types and methods of cleaning.

Corrosion. Corrosion in Condensers, Ernest Bate. Commonwealth Engr., vol. 8, no. 11, June 1, 1921, pp. 339-343, 8 figs. Discusses results of investigation and experiments of the condensers of the Ultimo & White Bay power houses, Sydney, N.S.W.

CONVEYORS

Belt. Interlocking Belt Conveyor System, A. M. Beebe. Gas Age-Rec., vol. 48, no. 3, August 6, 1921, pp. 105-107, 7 figs. Description of the electrically driven automatic system of the Rochester Gas & Electric Corp.

COST ACCOUNTING

Construction Work. Cost Accounting System for Construction Work, W. N. Connor. Eng. & Contracting, vol. 56, no. 3, July 20, 1921, pp. 66-70, 9 figs. Notes on use of daily labor cost reports; summary and analysis of estimate; timekeeping symbols and field sheet; wate and payroll sheets; invoice and material cost records; tabulating job cost by graphic method; final cost summary and cost comparison. (Abstract.) Paper presented before Boston Soc. Civ. Engrs.

Foundries. The Costing Problem in the Foundry, O. Bertoya. Metal Industry (Lond.), vol. 19, no. 2, July 8, 1921, pp.21-24. Notes on indirectly apportionable expenses and overhead charges; inspection; and records.

Methods. Necessuty of Proper Cost Accounting, J. B. Sehl. Iron Age, vol. 108, no. 7, August 18, 1921, pp. 391-393. Machine-rate or production-center method stressed. Distribution of overhead in bulk or by department. Why some methods fail.

Principles and Advantages. The Necessity of Proper Cost Accounting, J. B. Sehl. Forging & Heat-Treating, vol. 7, no. 7, July 1921, pp. 370-372. Describes principles of cost accounting and explains its advantages. Primary purposes of cost accounting are summarized as follows: (1) to ascertain actual cost; (2) to forecast in order to fix future selling prices; (3) to reduce costs; and (4) to increase efficiency.

Work in Progress Account. The Work in Progress Account: An Essential Feature in Modern Costing, Robert Stelling. Eng. & Indus. Management, vol. 5, no. 26, June 30, 1921, pp. 734-736, 1 fig. Notes on relation of turnover and finances, cost of idle time, etc.

COSTS

Engineering, Rise in. Rise in Engineering Costs—II, R. J. A. Pearson. Eng. & Indus. Management, vol. 5, no. 26, June 30, 1921, pp. 740-742, and vol. 6, no. 1, July 7, 1921, pp. 11-13, 5 figs. Data contained in paper read before Roy, Statiscal Soc. on comparison of pre-war and post-war costs in engineering.

CRANES

Safety Devices. Crane Safety Devices, Nicholas Prakken. Safety Eng., vol. 42, no. 1, July 1921, pp. 27-30. Deals with safety devices on class of cranes used in foundries, machine shops, yards, shipways and warehouses.

Travelling. Electric Motor Drive for Travelling Cranes, Gordon Fox. Blast Furnace and Steel Plant, vol 9, nos 7 and 8, July and August 1921, pp 413-416, and 485-488, 3 figs Discusses question of manual versus magnetic control for cranes.

CUPOLAS

Chemical Reactions. Chemical Reactions in Foundry Cupolas, Y. A Dyer Iron Age, vol 108, no 5, August 4, 1921, pp 259-262 Actions and reactions Combustion, cupola gases, carbon ration, melting efficiency, metal losses and gains. Cupola balance sheet.

Use in Open-Hearth Practice. Use of Cupolas in Open-Hearth Practice, V. W. Aubel. Iron Age, vol 108, no 5, August 18, 1921, pp. 403-405. Melting high silicon and other pig iron continuously and supplying hot metal to four 60-ton basic furnaces.

CUTTING TOOLS

Lathe and Planer. Design of Lathe, Planer, Shaper and Slotter Tools. Can. Machy , vol. 26, no. 3, July 31, 1921, pp. 33-36, 10 figs. Factors which decide what shape of tool will prove most efficient for any given cutting operation.

CYLINDERS

Calculation. The Calculation of Thick and Thin Cylinders. Machy (Lond.), vol. 18, no. 458, July 7, 1921, pp. 421-422, 5 figs. Calculating method and examples.

D

DAMS

Hetch Hetchy Water Supply, San Francisco. Excavating the Foundation for Hetch Hetchy Dam. Eng. News-Rec., vol. 87, no. 6, August 11, 1921, pp. 222-224, 3 figs. Open cut method used on new San Francisco water-supply structure although depth reaches 146 ft. below flood-water level.

Schoharie Development, New York. Building the Gilboa Dam. Public Works, vol. 51, no. 1, July 2, 1921, pp. 1-6, 9 figs. Dam across Schoharie River is part of Schoharie development of Catskill water supply of New York City. Interesting features of dam and reservoir.

DIESEL ENGINES

Generator Driving. Diesel Engines for Generator Driving, C. S. Darling. Beama, vol. 9, no. 1, July 1921, pp. 41-45. Construction, operation, maintenance, etc. (Concluded.)

Investigations. Investigations of Diesel Engines—II (Untersuchungen an der Dieselmaschine), Kurt Neumann. Zeit. des Vereines deutscher Ingenieure, vol. 65, no. 30, July 23, 1921, pp. 801-804, 10 figs. Results of tests for determination of condition during combustion period and interchange of heat between gas and wall of engine cylinder. The separate phases of combustion are quantitatively determined, and the speed of combustion is established.

Lubrication. Lubrication of Marine Diesel Engines, Louis R. Ford. Marine Eng., vol. 26, no. 8, August 1921, pp. 623-627, 4 figs. Discusses low pressure and high- pressure systems, cylinder lubrication, selection of oil, oil filters, etc.

Marine. Injection and Combustion of Fuel-Oil, Part V, C. J. Hawkes. Motorship, vol. 6, no. 8, August 1921, pp. 655, 1 fig. Experiments with solid-injection and air-blast in marine Diesel engines. (To be continued.)

Problems in the Manufacture of Internal-Combustion Engines, John Holloway, Shipbuilding & Shipping Rec., vol. 18, no. 1, July 7, 1921, pp. 13-14. Suggestions on choice of material and best methods of machining various parts of marine Diesel engines.

Nobel. Development of the Nobel Diesel-Engine, Edwin Lundgren. Motorship, vol. 6, no. 8, August 1921, pp. 648-649, 4 figs. Reviews past work and describes progress of the two-cycle system. (To be continued.)

Recent Progress. Recent Progress in Large Diesel Engines for the Mercantile Marine, James Richardson. Engineering, vol. 112, no. 2899, July 22, 1921, p. 168. Includes list of important Diesel ships in service and building, giving particulars of their machinery. Paper read before Inst. Civ. Engrs.

DOCKS

Royal Albert Extension, London. The Royal Albert Dock Extension (South). Engineering, vol. 112, no. 2896, July 1, 1921, pp. 2-7, 20 figs partly on supp. plates. Details of work begun in 1912, including entrance lock and wing wall jetties, dry dock, caisson and lock gates, swing bridge, bascule bridge, crane jetties, transit sheds and crane equipment.

DRILLS

Manufacture and Treatment. Drill Steels: Their Manufacture and Treatment. E. A. Wraight. Min. Jl., vol. 134, no. 1480, July 2, 1921, pp. 489-490. Describes method employed at Ludlum Steel Co. Practical data relative to successful treatment of Leyner drills.

Tap. Tap Drill Sizes, E. C. Peck and T. F. Githens. Am. Mach., vol. 55, no. 5, Aug. 4, 1921, pp. 194-196, 4 figs. Elements to be considered. What constitutes government standard. Minimum and maximum limits for tap holes. Determining ideal drill size.

DROP FORGING

Cost Analysis. Analysis of Costs of Drop-Forging, R. J. Herdegen Iron Age, vol 108, no 6, Aug 11, 1921, pp 325-326 Comparison of steam and board drop hammers Rate of production studied as well as costs Dividing line established between types

Economical Shop Practice. Cutting Costs in a Drop Forge Shop, F. L. Prentiss Iron Age, vol 108, no 7, Aug 18, 1921, pp 385-388, 6 figs Trolley system used for handling work between hammers and furnaces Features include water-reclaiming plant

DRYDOCKS

Panama Canal. Shipbuilding at Balboa Pac Mar Rev., vol 18, no 7, July 1921, pp 419-420, 4 figs. Describes drydock and shops of Panama Canal

E

EDUCATION, ENGINEERING

Gas Course. University of Michigan Gas Course, J. Gerald Ames Gas Age, vol 48, no. 2 July 25, 1921, pp. 45-49 Course established under Prof A H White and under patronage of Mich. Gas Assn.

Prerequisites to Technical Study. Engineering Courses Should be of Professional Grade, Wm. H Burr. Eng. News-Rec., vol 87, no. 2, July 14, 1921, pp. 65-66. Argues that technical study should be preceded by three years of general college work. (Abstract). Paper read before Soc for Promotion of Eng. Education.

ELASTICITY

Elastic Limit. The Elastic Limit, William E. Dalby. Engineering, vol. 112, no. 2897, July 8, 1921, p. 81, 3 figs. Points out that limit of proportionality of material is not a fixed point, but varies with heat treatment and vanishes with overstrain. Paper read before Instn. Civ. Engrs.

ELECTRIC CIRCUITS

Grounds. Protection Against Earths, A. Roth. Electrician, vol. 87, no. 2253, July 22, 1921, pp. 101-103. (Abstract "B.B.C. Mitteilungen", vol. 8, p. 71). Discusses the connection of good earth protection and overhead networks, limitations of earth, protective devices, etc.

Motors. Determination of Fuse, Wire, Conduit and Switch Sizes for Motor Circuits. Elec. Rec., vol. 30, no. 1, July 1921, pp. 29- 33, 12 figs. Determinations for average application conforming to National Electric Code requirements.

Protection of. Protection of Industrial Circuits, Victor H. Todd. Power Plant Eng., vol. 25, no. 14, July 15, 1921, pp. 715-719, 12 figs. Methods and devices and their correct application.

ELECTRIC DISTRIBUTION

Conduits. Construction of Industrial Electrical Distribution Systems—III, V E. Johnson. Power Plant, Eng., vol. 25, no. 15, August 1, 1921, pp. 754-757, 16 figs. Discusses the subject of present-day conduit work.

Low-Voltage Overhead. Low-Voltage Overhead Distribution. Burkewood Welbourn. Engineering, vol. 112, no. 2897, July 8, 1921, pp. 87-88. Deals with certain important features of overhead system. Paper read before Instn. Civ. Engrs.

Underground Systems. Underground Distributing Systems, E. A. Reinman. Power Plant Eng., vol. 25, no. 16, August 15, 1921, pp. 810-813, 8 figs. Discusses schemes of layout, underground ducts, manholes, cables, protection, etc.

ELECTRIC DRIVE

Blooming Mill. Electric Drive for Blooming Mill Service B. M. Jones. Power Plant Eng , vol. 25, no. 14, July 15, 1921, pp. 721-724, 6 figs. Bethlehem Steel co. discards steam engine; results gratifying.

Paper Mills. Electric Driving in the Paper Mill, on Heat-Economy Lines, A. B. Mallinson. Jl. Instn. Elec. Engrs., vol. 59, no. 301, May 1921, pp. 538-553 and Discussion pp. 553-563, 10 figs. Discusses uses of steam in paper manufacture, classes of machinery driven, including suitable electrical gear, driving of the variable-speed end of paper machine. Table of machines converted to electrical working in the United Kingdom.

ELECTRIC FURNACES

Heat-Treating. Automatic Heat-Treating Furnaces, Gilbert L. Lachter. Iron Age, vol. 107, no. 26, June 30, 1921, pp. 1754-1755, 4 figs. Charging, treating, quenching and drawing performed and governed by automatic devices easily set.

Electric Furnace Treatment of Dies and Forgings, E. F. Collins. Forging & Heat Treating, vol. 7, no. 7, July 1921, pp. 387-392, 7 figs. Describes different types of furnaces. Paper presented at Am. Drop Forge Convention, Chicago.

Induction. New Type of Induction Electric Furnace. Iron Age, vol. 108, no 6, Aug. 11, 1921, pp. 344-346, 6 figs. Primary winding above bath. Experience with 2-ton unit. For refining molten metal and serving as holding reservoir and melting ferromanganese.

Resistance Type. Electric Furnace Heat Treatment, E. F. Collins. Iron Age, vol. 108, no. 5, Aug. 4, 1921, pp. 266-267 and (discussion) pp. 267-268. Dies and forgings said to be well handled in metallic resistor furnaces. Uniformity of product a big feature. (Abstract) Paper read before Am. Drop Forge Assn.

Steel. Electric Furnaces for Making Steel, Alfred Stansfield. Blast Furnace and Steel Plant,vol. 9, nos. 7 and 8, July and August 1921. pp. 424–425, 2 figs., and 488–489, 2 figs. General features and advantages of Keller furnace and Stobie furnace. Classification of electric steel-making furnaces. Advantages of electrode hearths arc furnaces having single arc and one movable electrode.

ELECTRIC GENERATORS, D.C.

Flash-Over, Prevention of. Ring fire and Flash-Overs, W.B. DeMuth. Power Plant Eng., vol. 25, no. 14, July 15, 1921, pp. 719-720. Remedies for elimination of these machine troubles.

ELECTRIC HEATERS

Immersion Type. Application and Use of Immersion Electric Heaters, John M. Strait. Elec. Rev. (Chicago) vol. 79, no. 5, July 30, 1921, pp. 161–163, 4 figs. Particulars of installing, size and capacity, precautions to be observed.

ELECTRIC LOCOMOTIVES

Industrial. Industrial Electric Locomotives. Engineer, vol. 131, no. 3417, June 24, 1921, pp. 666–667, 3 figs. Types built by English Electric Co.

Mechanical Advantages. Mechanical Advantages of Electric Locomotives Compared with Steam, Vincent L. Raven. Engineering, vol. 112, no 2899, July 22, 1921, pp. 164–165. Summarizes mechanical disadvantages of steam locomotive, and discusses fuel economy made possible by use of electric locomotives, together with maintenance costs, and various designs of electric locomotives depending upon method adopted to transmit power from motors to driving axles. Paper read before Instn. Civ. Engrs.

Steam vs. Electric Shunting Locomotives. Tramway & Ry. Wld., vol. 50, no. 3, July 14, 1921, pp. 11–13, 3 figs. Describes the advantages of electric over steam locomotives.

Switching. B.T.H. Electric Shunting Locomotives. Elec. Rev. (Lond.) vol 89, no. 2275, July 1, 1921, pp. 27–28, 2 figs. Details of a 10-ton and 22 ton shunting locomotives weighing 56 tons each and fitted with 90-hp. motors which can start a train weighing 160 tons on a grade of 1 in 27 and haul it on grade 10 mi. per hr.

ELECTRIC PLANTS

Temperature Measurement. Measuring Temperatures in Electric Installations (La mesure des Températures dans les Installations Électriques), M. Henry. L'Industrie Électrique, vol. 30, no. 698, July 25, 1921, pp. 265–270, 7 figs. Describes various thermometers and thermocouples and other indicators.

ELECTRIC POWER

Industrial Load, New York State. Industrial Load in the State of New York. Elec. World, vol. 78, no. 5, July 30, 1921, pp. 207–210, 3 figs. Amount of electrical energy used in New York State has increased over 100 per cent since 1914.

ELECTRIC TRANSMISSION LINES

Long, Design of. Analytical Determination of the Most Suitable Tension and Cross-Section For Long Transmission Lines (Determinazione Analitica Della Tensione E Sezione Di Linea Piu' Conveniente per Una Lunga Transmissione Elettrica), Claudio Castellani. L'Elettrotecnica, vol. 8, no. 21, July 25, 1921, pp. 471–473, 2 figs. Shows that the basis adopted by Fascetti and Melinossi cannot be justified mathematically.

Safety Features on High-Voltage. Safety Features on High Voltage Transmission Lines, C.O. von Dannenberg. Safety Eng., vol. 42, no. 1, July, 1921, pp. 15–17. Review of certain features in high voltage electrical installations to which particular consideration should be given.

Towers, Design of. Wind Pressures and the Design of Radio and High Transmission Towers, S.P. Wing. Elecn. 1 vol. 87, no. 2250, July 1, 1921, pp. 6–10, 9 figs. General conclusions drawn from experiments to determine increase of wind pressure with height.

ELECTRIC WELDING

Oil Tanks. The Electric Welding of Oil Storage Tanks, William Schenstrom. Ry. Elec. Engr. vol. 12, no. 7, July 1921, pp. 267–271, 6 figs. Welded construction eliminates loss from leakage and it is estimated tanks will outlast riveted containers. (Abstract.) Paper presented before Am. Welding Soc.

Percussive. Electric Percussion Welding. (La Soudure Électrique Par Percussion), L'Industrie Électrique, vol. 30, no. 696, June 25, 1921, pp. 229–231. Applications and advantages of this process.

ELECTRIC WELDING, ARC

Advantages. Electric Arc Welding, Henry M. Sayers. Tramway & Ry. Wld., vol. 50, no. 3 ,July 14, 1921, pp. 25–29, 12 figs. Notes on its increased use successes, difficulties and failures.

Cost Data. Notes on Electric Arc Welding, H. L. Gnland. A.S.R.E. Jl., vol. 7, no. 6, May 1921, pp. 420–430 and Discussion pp. 430–431. Gives cost figures for arc welding and a comparison between gas and electric equipment.

Heavy Sections. Welding of Heavy Sections by the Electric Arc. Can. Machy., vol. 26, no. 2, July 14, 1921, pp. 32–33 and 46, 2 figs. Instructions for preparing work to be welded. Welding of cast iron is classed under four heads. (Abstract.) Book entitled Electric Arc Cutting and Welding, published by Elec. Arc Cutting and Welding Co., Newark, N.J.

EMPLOYEES

Care of. The Human Machine in Industry, Walter J. Matherly. Am. Mach., vol. 55 no. 6. Aug. 11, 1921, pp. 226–227. Care of human machine as important as care of machines of metal. Length of working day. Periods of rest. Fuel.

EMPLOYMENT MANAGEMENT

Psychotechnical Tests. Psychotechnical Adaptability Tests and Their Use in Metallurgical Works (Die psychotechnishe Eignungsprüfung und ihre Anwendung auf Hüttenbetriebe). Stahl u. Eisen, vol. 41, no. 24, June 16, 1921, pp. 822–827. Contributions by H. Hüttenhain, Heinrich Roser, and Hans Daiber. Report of the Machine Committee of the Assn. German Steel Works Engrs.

EXECUTIVES

Training. Co-operating to Educate a Community's Executives, H. C. Stevenson. Factory, vol. 27, no. 2, August 1921, pp. 182–187, 4 figs. Describes efforts of Rochester Industrial Management Council in this direction.

EXHAUST STEAM

Oil Removal from. Eliminating Cylinder Oil from Exhaust Steam, W. H. Wakeman. Power Plant Eng., vol. 25, no. 15, August 1, 1921, pp. 749–752, 8 figs. Discusses the essential features in a separator to give satisfactory results.

Utilization. Exhaust Steam; Its employment for Power, Heating, Etc., Ernest Richard Dolby. Engineering, vol. 112, no. 2897, July 8, 1921, p. 74. Notes on better utilization of heat in steam. In author's opinion, most efficient utilization of thermal value in coal cannot be obtained until there are sets of public mains provided by community for public utility. Paper read before Instn. Civ. Engrs.

The Utilization of Exhaust steam in Turbines, Maurice Deacon. Engineering, vol. 112, no. 2899, July 22, 1921, pp. 165–166, 3 figs. Describes general arrangement of mixed-pressure turbine plant. Cost of generating electrical power by exhaust steam is very low due to fact that steam would otherwise be wasted. Paper read before Instn. Civ. Engrs.

EVAPORATORS

Multiplex Film. Multiple Effect Evaporation. Burton Dunglinson. Chem. & Metallurgical Eng., vol. 25, no. 3, July 20, 1921, pp. 110–115, 7 figs. Discussion of multiplex film evaporator as regards features of construction and operation. Comparison of multiplex with other types.

F

FACTORY MANAGEMENT

See Industrial Management.

FEEDWATER HEATERS

Types. Selection of Feed Water Heaters for Power Plants, Robert June. Elec. Rev. (Chicago), vol. 79, no. 3, July 16, 1921, pp. 81–84, 4 figs. Relative merits of open and closed heaters. Heated feedwater is said to reduce strains and increases boiler output.

FIRE PREVENTION

Dust Explosions. Incandescent Lamps Used in Dust-Laden Atmosphere, D. J. Price & H. R. Brown. Elec. Rev., vol. 79, no. 5, July 30, 1921, pp. 165–166, 1 fig. Shows that they constitute a fire and dust-explosion hazard unless properly installed and adequately protected.

FLOUR MILLS

Rolls. The Manufacture of Chilled Iron Rolls. Am. Miller, vol. 49, no. 8, August 1, 1921, pp. 822–823, 10 figs. Processes employed in producing high grade rolls for flour milling.

FLOW OF WATER

Manning vs. Kutter's Formula. Manning's Formula Better Than Kutter's. Eng. News-Rec., vol. 87, no. 3, July 21, 1921, p. 96, 2 figs. H. W. King suggests that an abbreviated form of Kutter's equation, eliminating the *s* or slope terms, will give far more consistent results, and that in his opinion Kutter's formula will give just as satisfactory results without the *s* terms.

Riveted Steel Pipes. Flow of Water Through Galvanized Spiral Riveted Steel Pipe, F. W. Greve. Eng. News-Rec., vol. 87, no. 4, July 28, 1921, pp. 159–160, 3 figs. Results of experiments performed in hydraulic laboratory of Purdue University to determine variation of friction loss with velocity for flow; variation in accuracy of four types of piezometer rings; and friction loss compared with that in cast-iron pipes for like conditions of diameter and velocity.

FORGING

Costs. Comparative Analysis of Forging Costs, R. T. Herdegen. Forging & Heat Treating, vol. 7, no. 7, July 1921, pp. 397-399. States that it costs more to operate a 1500-lb. steam drop hammer than to operate a 1600-lb. board hammer, and it is not desirable to install a steam drop smaller than 2500 lb.

Manipulators. Mechanical Manipulator for Heavy Forgings. Engineering, vol. 112, no. 2899, July 22, 1921, p. 151, 4 figs. partly on p. 154. Machines constructed by Alliance Machine Co., Alliance, Ohio.

FOUNDATIONS

Bearing Value of Soils. The Bearing Power of Soils, Arthur L. Bell. Engineering, vol. 112, no. 2898, July 15, 1921, p. 132. Brief outline of progress in theories of earth pressure and bearing value of soils for foundations. Paper read before Instn. Civ. Engrs.

Concrete. Foundations, J. C. Hawkins. Power Plant Eng., vol. 25, no. 15, August 1, 1921, pp. 760-762, 5 figs. Templets, forms and process for mixing and placing concrete.

FOUNDRIES

Safety Provisions. Safety in Foundry Equipment, A. R. Bartlett. Mech. Wld., vol. 70, no. 1803, July 22, 1921, pp. 70-72. Discusses danger signs, foundry yard, foundry floor, ventilating and lighting, cranes, chains and slings,etc.

FRAMES

Rigid, Calculation of. Graphic Investigation of Rectangular Rigid Frames (Zeichnerische Untersuchung rechteckiger Steifrahmen), J. Polivka. Beton u. Eisen, vol. 20, no. 4-5, Mar. 7, 1921, pp. 57-60, 12 figs. Graphic calculating method for determination of the moments and normal forces in closed and fixed-in rigid frames.

FREIGHT HANDLING

Mechanical. Mechanical Freight Handling on the New York Central Lines, William T. Gaynor, Transportation Wld., vol. 3, no. 5, July-August 1921, pp. 11-12, 1 fig. Shows the influence of local conditions on mechanical handling methods.

Unit Cost Data. Unit Cost Data Reduce Freight Train Expense, J. E. Hutchison. Ry. Age., vol. 71, no. 4, July 23, 1921, pp. 161-163, 1 fig. Prompt distribution of information aids in cutting wage charges per hundred ton miles. Shows form used in reporting wage cost of handling trains on St. Louis-San Francisco railway system.

FUELS

Colloidal. Colloidal Fuel. Pac. Mar. Rev., vol. 18, no. 7, July 1921, pp. 394-396, 1 fig. Article compiled from interviews with and printed material submitted by Linden W. Bates, who controls basic patents covering process for colloidalization of oil and fuels. Describes small colloidalizing plant, and points out principal advantages of colloidal fuel.

Colloidal Fuel Applied to Bar-Heating Furnaces Engineering, vol. 112, no. 2898, July 15, 1921, pp. 124-125, 5 figs. Report by J. C. Marble on trials, made on rod-heating furnace at Swansea Works of Steel Co. of Canada. Attention is drawn to fact that fuel, though old, showed no signs of sedimentation, and that owing to its specific gravity fire risk was capable of being greatly reduced as compared with oil.

Industrial Heating. Selection of Fuel for Industrial Heating. Chem. & Metallurgical Eng., vol. 25, no. 3 July 20, 1921, pp. 116-118, 1 fig. Includes chart showing comparative fuel costs, and table giving characteristics of various industrial gases. (Abstract.) Pamphlet copyrighted by W. S. Rockwell Co.

See also Carbocoal; Coal; Coke; coke Breeze; Oil Fuel; Peat; Pulverized Coal; Tar Oils.

FURNACES, HEAT-TREATING

Die Blocks, for. Furnaces for Heat Treatment of Die Blocks, S. Trood. Forging & Heat Treating, vol. 7, no. 7, July 1921, pp. 393-397, 7 figs. Discusses proper proportioning and mixing of fuel and air, temperature of ignition; time element, velocity and space required by products of combustion and recirculation.

Molydenum Steel Parts. Special Heat-Treating Furnaces for Molydenum Steel Parts. Automotive Manufacturer, vol. 63, no. 4, July 1921, pp. 19-21, 4 figs. Description of unusual automatic furnaces installed and principle of operation.

FUSION WELDING

Possibilities. The Possibilities of Fusion Welding, A. S. Kinsey. Iron Age, vol. 108, no. 6, Aug. 11, 1921, pp. 337-338. Conditions for this type of weld. Control of Welders. Test of welds. Success with alloy steels. (Abstract.) Address before Cleveland Section Am. Welding Soc.

G

GAGES

Economic Selection. Suggestions for an Economic Selection of Types of Gages from the Systems of Standard Holes and Standard Shafts (Richtlinien für eine wirtschaftliche Auswahl der Lehrenarten aus den Systemen der Einheitsbohrung und der Einheitswelle), K. Gottwein, Betrieb, vol. 3, no. 18, June 10, 1921, pp. 266-273, 10 figs. Author's recommendation is approved by sub-committee of German Industry Committee on Standards (NDI), and is thought to be especially adapted to mixed production, for giving the different firms a basis for selection of the necessary gages for all cases in which the use of unit system is not required.

Hoke. Hoke Gages, Earle Buckingham. Army Ordnance, vol. 2, no. 1, July-August 1921, pp. 36-38, 4 figs. Discusses the importance of accurate gages in the production of munitions.

Industrial. Study of Industrial Gages at International Bur. of Weights and Measures (L'Étude des Calibres Industriels au Bureau international des Poids et Mesures). Le Génie Civil, vol. 78, no. 24, June 11, 1921, pp. 500-503, 9 figs. Standard Gages of Johansson type. Gaging by light-interference method. (Concluded.)

GASOLINE

Engine, Specifications for. Problems Involved in Developing Engine Gasoline Specifications, E. W. Dean. Jl. Soc. Automotive Engrs., vol. 9, no. 2, August 1921, pp. 131-132. Gives general properties of satisfactory engine gasoline and specification limits.

GEAR CUTTING

Hobbing Worms. A Novel Method of Hobbing Worms. Automotive Ind., vol. 45, no. 4, July 28, 1921, pp. 171-172, 3 figs. Uses a helicoidal cutter.

Methods. Recent Gear-Cutting Practice.—IX. Mech. Wld., vol. 70, no. 1803, July 22, 1921, pp. 58-59, 14 figs. Discusses small spur gears, including internal and ratchets. (To be continued.)

Multiple Shapers. Cuts Teeth of a Gear at One Operation. Iron Age, vol. 108, no. 4, July 28, 1921, pp. 197-200, 7 figs. Stevenson multiple shaper, how it operates and its field.

Racks. A New Rack Cutting Attachment. Eng. Prod., vol. 3, no. 44, August 4, 1921, pp. 100-101, 4 figs. Details of a useful device for use on milling machines.

GEARS

Comparator, Gear-Tooth. The Sykes Gear Tooth Comparator. Machy. (Lond.), vol. 18, no. 459, July 14, 1921, pp. 454-455, 3 figs. For comparing and measuring thickness of gear teeth.

Teeth, Strengthened. Strengthened Gear Teeth. Eng. Production, vol. 3, no. 41, July 14, 1921, pp. 28-30, 8 figs. Notes on principles applied. Includes summary of various formulas for long addendum gear teeth.

Testing Machine for Teeth. The Odontometer for Testing Gear Teeth, Earle Buckingham. Machy. (Lond.), vol. 18, no. 458, July 7, 1921, pp. 412-413, 6 figs. Describes instrument for testing accuracy or uniformity of gear-tooth profiles and spacings of teeth in production work, developed by Pratt & Whitney Co.

GRINDING

Automobile Parts. Grinding in the Automobile Industry—I. P. M. Heldt. Automotive Ind., vol. 45, no. 6, August 11, 1921, pp. 265-269, 11 figs. Describes the various kinds of grinding wheels, their selection, cutting speeds, balancing, truing, etc.

Data. Recent Data on Grinding Room Production. Abrasive Industry, vol. 2, no. 7, July 1921, p. 241. Data on grinding valves, steel pins, square shafts and valve stems.

H

HEAT TRANSMISSION

Problems. A Survey of Heat Transmission Problems, W. M. Selvey. Elecn., vol. 87, no. 2250, July 1, 1921, pp. 11-12. Review of trilogy of books by R. Royds entitled, Measurement of Steady and Fluctuating Tempeartures; Heat Transmission by Radiation, [Conduction and Convection; and Heat Transmission in Boilers, Condensers and Evaporators.

HEATING FACTORY

Requirements. Requirements for Industrial Heating, Harold Fulwider. Elec. World, vol. 78, no. 4, July 23, 1921, pp. 167-169, 22 figs. How to determine power required for ovens and energy comsumption per unit of product. Tyical calculations for japanning and core-baking ovens. Selection of ventilating equipment.

HOBBING MACHINES

Hobbing Worms, New Method of. Gould & Eberhardt Method of Hobbing Worms. Am. Mach., vol. 55, no. 4, July 28, 1921, pp. 141-142, 3 figs. Worms cut with hob having a broaching action. Short hob permits cutting worms having shoulders at both ends.

Theory and Practice. Hobs and Hobbing, T. A. Stoddart. Eng. Prod., vol. 3, no. 44, August 4, 1921, pp. 102-104, 4 figs. Theory and practice of modern machines.

HOISTS

Mine. The Graphical Dynamics of a Winding Engine—III, Charles D. Mottram. Colliery Guardian, vol. 122, no. 3159, July 15, 1921, pp. 170-171, 5 figs. Discusses the question of friction between lubricated surfaces. (To be continued.)

HOUSES, CONCRETE

England. Concrete House Building. Concrete & Constructional, Eng., vol. 16, no. 7, July 1921, pp. 425-431, 10 figs. Housing scheme at Southport, England.

HYDRAULIC TURBINRS

Development. Recent Development of Water Turbines (Die neuere Entwicklung der Wasserturbinen), Dieter Thoma. Zeit. des Vereines deutcher Ingenieure, vol. 65, no. 26, June 25, pp. 679-686, 21 figs. Modern Francis turbines; new types of draft tubes and their influence on motion of water in rotor; limited sphere of present turbine theory; useful scope of Kaplan turbine; the Moody turbine; vctical single-wheel turbines; high-pressure Francis turbines with vertical shaft; transformer installations; success of Bauersfeld's analytical turbine theory.

HYDRGAEROPLANES

Caproni Giant. The Caproni Giant Hydroplane (L'hydravion triplan géant Caproni). Le Génie Civil, vol. 79, no. 2, July 9, 1921, pp. 39-40, 5 figs. Particulars of dimensions and tests.

HYDROELECTRIC PLANTS

California. Semi Automatic Operation Economical in Small Hydro Stations, E. R. Stauffacher & G. Clingwald. Elec. World, vol. 78, no. 5, July 30, 1921, pp. 213-216, 6 figs. Southern California Edison Company plant saves cost of extra equipment in seven months.

I

IGNITION

Magnets. Magnetos for Ignition Purposes in Internal Combustion Engines, E. A. Watson. Jl. Instn. Elec. Engrs., vol. 59, no. 301, May 1921, pp. 445-466, Discussions pp. 467-490, 26 figs. Discusses conditions to be fulfilled by ignition magnetos on internal combustion engines and deals with the principles of operation of a magneto.

IMPACT TESTING

Suggestions. Impact Tests and Allowances, Harry John Fereday. Engineering, vol. 112, no. 2897, July 8, 1921, p. 80. Suggestions for conducting future tests in order to obtain, if possible, new formula for impact effect. Paper read before Instn. Civ. Engrs.

INDUSTRIAL MANAGEMENT

Cost Reduction. Reducing Manufacturing Costs by Studying Power Demand, R. S. Lowry. Elec. Wld., vol. 78, no. 6, August 6, 1921, pp. 257-258. Draws attention to inefficient operating-conditions and causes of unnecessary expenditures.

Efficiency Control. Controlling Efficiency in the Clay Plant, Arthur H. Kaeppel. Brick & Clay Rec., vol. 59, no. 3, August 9, 1921, pp. 188-191, 3 figs. Discusses factory efficiency reports and production charts.

Factory Statistics. Factory Statistics (Betriebsstatistik), Rudolf Reischle. Zeit. des Bayerischen Revisions-Vereins, vol. 25, nos. 10, and 11, May 31 and June 15, 1921, pp. 81-84 and 94-95, 3 figs. Deals with purposes and character, fundamental principles, carrying out and utilization of factory statistics; bookeeping and net cost accounting; commercial bases for calculating of general operating costs.

Follow-Up System. Follow-Up System for the Drawing Office. Machy. (Lond.), vol. 18, no. 457, June 30, 1921, pp. 385-388, 6 figs. System for recording status and daily progress of work during process of manufacture.

Inspection. An Inspection and Progress System. E. A. Allcutt, Eng. & Indus. Management, vol. 6, no. 3, July 21, 1921, pp. 59-61 and 64. Explains the three main objects of successful management; good work, rapid work, economical work.

Overhead Costs. Cutting Overhead Cost Instead of Wages, Don. F. Kennedy. Iron Age, vol. 108, no. 2, July 14, 1921, pp. 79-81. Large Detroit automobile company paid war-time wages, ran half time and in same period made profits.

Purchasing System. What is a Comprehensive Purchasing System? Wilfred G. Asble. Can. Machy., vol. 26, no. 2, July 14, 1921, pp. 27-29, 9 figs. Suggestions for organizing effective system, Illustrations of form cards suitable for purchasing department.

Small Shop. Organization and Management of the Small Shop—I, II and III, Elmer W. Leach. Am. Mach., vol. 55, nos. 3, 5 and 7, July 21, Aug. 4, and 18, 1921, pp. 81-84, 190-193 and 262-266. July 21: How one small shop started and won battle against odds. Aug. 4; How to analyse manufacturing and marketing problems. Aug. 18: Methods of market analysis; different ways of reaching ultimate consumer; importance of establishing definite sales policy.

Storeroom Methods. Six Ways to Simplify Stockroom Routine, V. C. Kreuter. Factory, vol. 27, no. 2, August 1921, pp. 192-194, 5 figs. Shows how, through changes in stockroom routine, difficulties in routing, production, cost-keeping and inventory work may be adjusted.

Stores Keeping. Continuous Stores Keeping Cuts Investment. Iron Age, vol. 108, no. 5, August 4, 1921, pp. 253-254, 2 figs. System checks and almost automatic control of ordering materials economizes in space required and in amount carried.

Toolroom Organization. Organization of the Toolroom, G. W. Tripp. Eng. & Indus. Management, vol. 6, no. 1, July 7, 1921, pp. 2-5, 3 figs. Outlines method of organizing tool room. Notes on arrangement of tool store, manufacture of jigs, grouping of cards and planning of work.

See also time study.

INDUSTRIAL RELATIONS

Justice In. The Way Out in Industrial Relations, John Calder. Iron Age, vol. 107, no. 26, June 30, 1921, pp. 1766-1767. How shall management, labor and public secure justice? What underlies. movement for a conference fonting in individual companies. (Abstract.) Address before Iowa Mfrs. Assn.

INSULATION

Tests on D. C. Systems. Insulation Tests on Live D. C. Systems, G. W. Stubbings. Beama, vol. 9, no. 1, July 1921, pp. 38-40. Describes instrument for directly indicating insulation resistance of d. c. network, devised by W. E. Groves, consisting of an ammeter and voltmeter, with overlapping pointers, and used in conjunction with Russell's test.

INTERNAL-COMBUSTION ENGINES

Cast Iron, Use of. Cast Iron in the Construction of Internal Combustion Engines. Eng. & Indus. Management, vol. 5, no. 26, June 30, 1921, p. 736. Describes effect of increases of temperature on gray cast iron employed in construction of automobile cylinders and pistons.

Influence of Fuels. The Influence of Various Fuels on the Performance of Internal Combustion Engines—VI, H. R. Ricardo. Automobile Engr., vol. 11, no. 152, July 1921, pp. 242-247, 6 figs. Experimental investigation into their behavior.

Installation. Practical Notes on the Installation and Running of Petrol, Petrol-Paraffin, and Semi-Diesel Engines, D. P. Lamb. Mech. Wld., vol. 70, no. 1803, July 22, 1921, pp. 72-73. Considers shafting, motor-seating, stern tube, fuel tanks, etc. (To be continued.)

Large Cylinders. Internal-Combustion Engines with Large Cylinders, James McKechnie. Engineering, vol. 112, no. 2898, July 15, 1921, pp. 132-134, 5 figs. includes indicator cards and summaries of some of the trials of engines referred to, and also of Vickers' Narrangasett type commercial marine engine with 24½-in. cylinder. Paper read before Instn. Civ. Engrs.

Types. The Internal Combustion Engine. Steamship, vol. 33, no. 386, August 1921, pp. 49-53, 14 figs. Description of the two-stroke-cycle, four-stroke-cycle and semi-Diesel engines.

See also Aeroplane Engines; Automobile Engines; Diesel Engines; Gas Engines; Oil Engines, Semi-Diesel Engines.

IRON

Corrosion. A New Theory of the Corrosion of Iron, J. Newton Friend. Am. Electrochemical Soc. 40th Gen. Meeting 1921, advance paper, June 4, 1921, 13 pp. 9 figs. Writer puts forward auto-colloidal catalytic theory which postulates corrosion as starting by formation of colloidal ferrous hydroxide, which latter is alternately reduced by contact with iron and oxidized by contact with air, thus continuing corrosion and production of rust.

IRON AND STEEL

Canada. The Present Status and Future Possibilities of the Iron and Steel Industry in Canada, J. F. K. Brown. Iron & Steel of Can., vol. 4, no. 6, July 1921, pp. 159-166. Review of fundamental conditions of existence and growth of iron and steel manufacture, and discussion of advisibility of capital investment in iron and steel enterprises in Canada.

Protective Coastings. The Relative Values of Protective Metallic Coatings for Iron and Steel, Sherrard O. Cowper-Coles. Engineering, vol. 112, no. 2899, July 22, 1921, p. 167. Relative advantages and disadvantages of zinc coatings. Discusses four methods in which it can be applied, namely dipping in molten zinc, sherardizing, electro-zincing and spraying Paper read before Instn. Civ. Engrs.

IRON FOUNDING

Centrifugal Casting. Chill Casting and Centrifugal Casting (La Coulée en Coquille et par Centrifugation) La Fonderie Moderne, no. 4, April 1921, pp. 87-89, Discusses operation of both methods.

J

JIGS

Design and Use. Jigs for Intensive Production. Eng. Production, vol. 3, no. 40, July 7, 1921, pp. 8-12, 14 figs. Observations on design and use of typical examples.

L

LATHE TOOLS

Ring Tools. The Ring Tool. Engineering ,vol. 112, no. 2898, July 15, 1921, pp. 95-96, 5 figs. Article is said to complete geometry of ring tool and will be found useful for reference in drawing offices using these tools extensively.

LATHES

Turret. Obtaining Production on the Vertical Turret Lathe. Machy. (Lond.), vol. 18, no. 459, July 14, 1921, pp. 447-453, 18 figs. Application of vertical boring and turning mill to machine shop practice, including typical examples and description of tooling used.

Tooling in the Modern Turret Lathe. Eng. Production, vol. 3, nos. 42 and 43, July 21 and 28, 1921, pp. 61-66, 18 figs, and 83-89, 19 figs. Methods and fixtures for economical production.

LIGHTING

Charts and Data. Charts and Data for Industrial Lighting Designs, P. A. Powers. Elec. Rev., vol 79, no. 7, August 13, 1921, pp. 231-234, 4 figs. Height of suspension related to spacing ,reflector and lamp.

Illuminating Engineering. Illuminating Engineering, J. H. Asdell. Beama, vol. 9, no. 1, July 1921, pp. 25-29. Future field.

Office Buildings. High-Intensity Illumination of Office Buildings, Ivan M. Kirlin. Elec. Rev. (Chicago), vol. 79, no. 7, August 13, 1921, pp. 235-238, 7 figs. Equipment employed and results obtained in lighting new offices of the Detroit Edison Co.

Railway Buildings. Electric Lighting of Railway Buildings, J. H. Kurlander. Ry. Elec. Engr., vol. 12, no. 7, July 1921, pp. 273-277, 11 figs. Three fundamental considerations of successful lighting installation are said to be intensity, quality and distribution. Recommendations.

LOCK WASHERS

Standards for. Current Standardization Work. Jl. Soc. Automotive Engrs., vol. 9, no. 2, August 1921, pp. 118. Gives proposed dimensions of lock washers.

LOCOMOTIVE BOILERS

Repairing Cracks Tubeplates. Repairing Cracks in the Copper Tubeplates of Locomotive Boilers, A. Wrench. Engineering, vol. 112, no. 2902, Aug. 12, 1921, pp. 251-252, 11 figs. Discusses methods of repairing.

Steel vs. Brass Tubes. Steel or Brass Boiler Tubes For Locomotives. (Le Tube de Chaudière de Locomotive acier ou Laiton), O. Hock. Revue Universelle des Mines, vol. 10, no. 2, Series 6, July 15, 1921, pp. 117-128. Discusses the influence of the war and price of metals, life of steel tubes, etc. (To be continued.)

LOCOMOTIVES

Air-Operated Auxiliaries. Maintenance of Air Operated Auxiliaries. Ry. Mech. Engr., vol. 95, no. 8, August 1921, pp. 484-487, [5 figs. Discusses saving effected by the application of Air Brake Association condemning limits.

Booster Tests. Locomotive Booster Tests on Timiskaming & Northern Ontario Railway. Can Ry. & Mar. World, no. 280, July 1921, pp. 356-357, 4 figs. Results of tests conducted with Can. Nat. Rys. dynamometer car 84.

British. Great Central Railway Four-Cylinder Engines—III. Supp. 3. Engineer, vol. 131, no. 3417, June 24, 1921, pp. 660-661, 5 figs. Characteristics: Type, 4—6—0; driving effort, 29,500 pounds; diameter of driving wheels, 5 ft. 8 in.

Heavy Locomotive Work on the Great Northern Railway (England). Ry. Gaz., vol. 35, no. 1, July 1, 1921, pp. 11-14, 3 figs. Passenger trains with 18 to 20 coaches and weighing from 590 to 650 tons are daily hauled between Doncaster and London by one engine of No. 1000 class. Discusses performance of locomotives on recent typical run.

Consolidation. High Capacity Consolidation Type Locomotives. Ry. Rev., vol. 69, no. 7, August 13, 1921, pp. 197-205, 13 figs. Discusses design and equipment, fuel consumption, fuel and tonnage performance, etc. Tractive effort, 68,200 lb.

Cut-off Control. The Automatic Control of Locomotive Cut-off, E. S. Pearce. Ry. Mech. Engr., vol. 95, no. 8, August 1921, pp. 488-493, 13 figs. Utilizing back pressure as actuating force.

Engine Design. Modern Locomotive Engine Design and Construction—LXXII. Ry. Engr., vol. 42, no. 498, July 1921, pp. 255-258, 2 figs. Considerations and factors determining most suitable cross section for locomotive connecting rods.

4-8-0. Recent Designs of Twelve-Wheel Locomotives. Ry. Age, vol. 71, no. 6, August 6, 1921, pp. 251-252, 4 figs. Description of various 4—8—0 type.

Mechanical Efficiency. Locomotive Resistance and Mechanical Efficiency, Kiichi Asakura. Ry. Age, vol. 71, no. 5, July 30, 1921, pp. 211-216, 9 figs. Establishes a formula for calculating mechanical efficiency.

Oil-Burning. Oil-Burning Locomotives in India and Mesopotamia, A. M. Bell. Ry. Engr., vol. 42, no. 498, July 1921, pp. 247-250, 6 figs. Information with regard to utilization of oil fuel for locomotives in the East.

Oil-Burning Locomotives on the Great Eastern Railway (England). Ry. Gaz., vol. 35, no. 1, July 1, 1921, pp. 9-10, 3 figs. Describes how G. E. R. locomotives are being fitted up for oil-fuel burning on the Holden system.

Shops, England. Methods Employed in the Locomotive Shops of the Great Western Railway Co., Swindon—IV. Machy. (Lond.), vol. 18, no. 458, July 7, 1921, pp. 405-407. Details of heat-treating plant and machining operations on various components of brake gear and link motion.

Superheaters. The application of Superheaters to Light Locomotives. Ry. & Locomotive Eng., vol. 34, no. 7, July 1921, pp. 188-189, 5 figs. Examples of recent construction in which installations have been made.

Tank. Heavy Tank Locomotives on the London & South Western Railway. Ry. Gaz., vol. 35, no. 1, July 1, 1921, pp. 16 and 22, 2 figs. New 4—8—0 side tank locomotive built for work at Feltham concentration yard and for transfer service between Nine Elms and Feltham.

LUBRICATING OILS

Carbonization in internal-Combustion Engines. The Carbonization of Lubricating Oils in Internal Combustion Engines, Frederic H. Garner. Jl. Instn. Petroleum Technologists, vol. 7, no. 26, Apr. 1921, pp. 98-126 and (discussion and bibliography) pp. 126-148, 8 figs. Methods of determining asphaltic resins in lubricating oils was devised by utilizing the selective absorbent power of animal charcoal. Results of experimental work on evaporation and carbonization of series of lubricating oils derived from Texas and Pennsylvania crudes.

Viscosity-Temperature Chart. A New Chart for Viscosity-Temperature Relations. Lubrication, vol. 7, no. 8, June 1921, pp. 5-8, 2 figs. Presents chart one of important features of which is that every known lubrication oil can be shown comparatively.

LUBRICATION

Steam Cylinder. Steam Cylinder Lubrication. Lubrication, vol. 7, no. 6, June, 1921, pp. 1-4 and 9-13. Notes on what the oil must lubricate; how it can best be applied, conditions under which it must operate; selection of oils, and how to tell if lubrication is correct.

M

MACHINE SHOPS

High-and Low-Bay Type. The High and Low Bay Type of Machine Shop, Fred H. Colvin. Am. Mach. vol. 55, no. 3, July 21, 1921, pp. 91-93, 7 figs. Wide, high bays, with low bays between, give light from both sides. Standard columns and shapes make rearrangement easy at any time.

MACHINERY

Foundation Bolts. Elements of Design for Foundation Bolts of Machines, Terrell Croft. Coal Age, vol. 20, nos. 2 and 3, July 14 and 21, 1921, pp. 45-51, 9 figs., and 95-99, 13 figs. Summary of available information concerning design of machinery foundations and holding-down bolts necessary. Devices to increase holding power of anchor bolts; relative value of neat cement, sulphur and lead.

MARINE STEAM TURBINES

Gearing. Marine Steam-Turbine Gearing, J. Hamilton Gibson. Trans Inst. Mar. Engrs., session 1921-22, June 1921, pp. 115-126 and 127-143, 1 fig. on p. 144. Deals with essential elements of manufacture, erection and running

MATERIALS

Storage. Principles of Storage. Iron Age, vol. 108, no. 4, July 28, 1921, pp. 194-196, 8 figs. Experience and practices of Pittsburg railways summarized.

METAL SPRAYING

Schoop Process. Progress in Metal Coating, Schoop Process of Spraying Metal or Alloys (Les Progrès de la Métallisation, Procédé Schoop Par Pulverisation de Métaux ou Alliages Fondus), P. Nicolardot. Chimie & Industrie, vol. 5, no. 6, June 1921, pp. 619-635, 26 figs. Describes the Schoop process, apparatus and applications in industry.

METALLOGRAPHY

Foundry Uses. Use of Metallography in Metal Foundries (Anwendungen der Metallographie in der Metallgiesserei), Rudolf Stotz. Giesserei-Zeitung, vol. 18, nos. 13 and 14, July 5 and 12, 1921, pp. 207-211 and 215-220, 32 figs. Discusses internal structure of metals and alloys in relation to foundry practice. Address delivered before Assn. German Metal Foundrymen.

METALS

Annular Cracks. Annular Cracks, R. R. Clarke. Metal Industry (Lond.) vol. 19, no. 2, July 8, 1921, pp. 27-28, 2 figs. Discusses various theories for their formation.

Calorizing. Calorizing as a Protection for Metals, A. V. Farr. Forging & Heat-Treating, vol. 7, no. 7, July 1921, pp. 384-386, 4 figs. Also in Blast Furnace and Steel Plant, vol. 9, no. 7, July 1921, pp. 431-433. Recent developments. Characteristics of a good protective coat. Materials that can be calorized. Cost and various applications. (Abstract.) Paper read before Eng. Soc. West. Pa.

MINING

Cost Statement. A Standard Mine Cost Statement, H. J. C. MacDonald. Eng. & Min. Jl., vol. 112, no. 4, July 23, 1921, pp. 126-131, 2 figs. Points out that stoping and development expenses may be so recorded as to give clear insight into past and current operations and to indicate future economies.

MOLDING MACHINES

French Practice. Mechanical Molding Practice. (La Pratique de Moulage Mécanique), G. Pouplin. La Fonderie Moderne, no. 5, May 1921, pp. 128-137, 6 figs. Discusses various methods for molding grate bar and aluminum casings for motor cars.

Operation. Machine Molding (La Pratique de Moulage Mécanique), G. Pouplin. La Fonderie Moderne, no. 4, April 1921, pp. 92-102, 7 figs. Describes the operations in detail. (To be continued.)

MOLDING METHODS

Follow-Board Use. Accentuates Use of Follow Board Pat. Dwyer. Foundry, vol. no. 15, August 1, 1921, pp. 585-590, 11 figs. Match plates extensively used in new foundry equipment.

Gating. Elevated, Midway, and Subway Gating, William H. Parry. Am. Mach., vol. 55, no. 6, Aug. 11, 1921, pp. 209-210, 8 figs. Using three-part flasks on two-part work to increase production. Arrangement of gates and runners. Abandoning horn gate.

Physical Properties. The Value of Molybdenum Alloy Steels, G. W. Sargent. Trans. Am. Soc. Steel Treating, vol. 1, no. 10, July 1921, pp. 589-596 and (discussion) pp. 596-597, 5 figs. Notes on manufacture and Physical properties.

MOTORSHIPS

Oil-Burning Steamers vs. The Internal-combustion Engine As Applied To Marine Propulsion, John F. Metten & J. C. Shaw. Shipbuilder, vol. 25, no. 132, August 1921, pp. 86-90, 1 fig. (Abstract paper communicated to Am. Soc. Naval Architects & Marine Engrs.) Discusses two-cycle and four-cycle engines and gives comparative data of a motorship with an oil-burning steamer.

MOTOR-TRUCK TRANSPORTATION

Chicago. Motor Truck Haulage in Chicago. Elec. Ry. Jl., vol. 58, no. 4, July 23, 1921, pp. 133-135, 4 figs. North Shore line has receiving station close to Chicago Loop and hauls merchandise on trucks to rail terminal. Study shows service to be costly taken by itself, but valuable as business producer.

Development and Future. The Development and Future of Handling Freight by Motor Trucks. Jl. Engrs.' Club of Phila., vol. 38-6, no. 198, June 1921, pp. 225-240. Better Highways and Motor Transportation as an Aid to Production, F. W. Fenn. The Motor Truck and Legislation, R. A. Hauer. Motor Truck Operation in Southern Maryland, M. O. Eldridge. Discussions.

MOTOR TRUCKS

Cushioning in. Cushioning in Motor-Truck Design, Charles O. Guernsey. Jl. Soc. Automotive Engrs., vol. 9, no. 2, August 1921, pp. 143-147 and Discussion pp. 147-150, 10 figs. Considers chassis stresses, cushion tires and wheels and elimination of vibration.

N

NAVIGATION

Submerged Electric Cable. Electro-magnetic Piloting of Ships. (Sur le pilotage électro-magnétique des navires). W. A. Loth. Revue Générale de l'Electricité, vol. 9, no. 5, June 18, 1921, pp. 899-903. Experiments at Brest and in U.S. on piloting ship by signals sent from submerged electric cable carrying alternating current.

O

OFFICE MANAGEMENT

Data Filing. Packard's Motor Transport Data Files, Dorsey W. Hyde, Jr. Filing and Office Management, vol. 6, no. 3, August 1921, pp. 71-73. Gives details of classification.

OIL

Conservation. Conservation M. L. Requa. Am. Petroleum Inst., no. 132, Dec. 10, 1920, pp. 54-59. Deals with present and future problems; water infiltration in California; Conservation Bureau's good work; wasteful fuel-oil consumption; future motor-fuel supply; development of supplementary resources; artificial gas; etc.

Production and Consumption. Production and Consumption. Am. Petroleum Inst., no. 132, Dec. 10, 1920, pp. 29-44. Addresses by R. D. Benson, Thomas A. O'Donnell, C. F. Kettering and W. S. Benson, on present and future production, consumption in the automotive industry and present and future demands of shipping for oil.

OIL ENGINES

Marine. Some Observations on Marine Oil Engines, D. M. Shannon. Trans. Inst. Mar. Engrs., session 1921-22, June 1921, pp. 145-164 and (discussion) pp. 165-174, 15 figs. Deals with various types, including Diesel and hot-bulb engines. Diagrams from various types of piston engines.

OIL FUEL

Production. Fuel Oil, W. A. Whyte. Steamship, vol. 33, no. 385, July 1921, pp. 6-12. Notes on origin, finding and refining of petroleum; statistics of output. Fire precautions and appliances for use on ships burning oils. Paper read before North-East Board of Engrs. & Shipbuilders.

OIL FIELDS

Canada. What Canada's New Oil Fields Have Disclosed, Alexander Gray. Can. Min. Jl., vol. 42, no. 30, July 29, 1921, pp. 593-604, 8 figs. Discusses mistakes made by geologists and general prospects.

OIL WELLS

Cementing. The Cementing of Oil Wells. Petroleum Times, vol. 6, no. 130, July 2, 1921, pp. 13-14, 1 fig. Details of the Halliburton cementing process.

Drilling. Drilling Oil Wells With the Diamond Drill, Frank A. Edson. Bul. Am. Assn. Petroleum Geol., vol. 5, no. 3, May-June 1921, pp. 386-393. Maintains that the diamond drill affords a means of obtaining much more accurate information and at no greater cost.

OIL SHALES

Northern Manitoba. The Search for Oil in the Pasquia Hills, R. C. Wallace. Preliminary report of commissioner for Northern Manitoba.

OPEN-HEARTH FURNACES

Improvements. Improvement in Open-Hearth Details, A. G. and A. F. Schumann. Iron Age, vol. 108, no. 5, August 4, 1921, pp. 269-272, 8 figs. New arrangement of reversing furnace valves promotes economy. Burners for liquid fuel and tar. Results in operation.

Relation of Temperature to Output. Discussion on Open-Hearth Practice, Henry Wm. Seldon, Blast Furnace and Steel Plant, vol. 9, no. 7, July 1921, pp. 422-423. Facts to be considered in relation to open hearth furnace temperature to furnace output.

OXY-ACETYLENE WELDING

Refrigerating Apparatus. Oxy-Acetylene Welding of Refrigerating Apparatus, Fred E. Rogers. A.S.R.E. Jl., vol. 7, no. 6, May 1921, pp. 432-450, and (discussion), pp. 450-451, 27 figs. Discusses the importance of true forms, manipulation of torch and welding rod, reinforcement of welds, size of welding rodx and tips. etc.

P

PAVEMENTS, BITUMINOUS

Advantages. Advantages of bituminous macadam, Alfred Dryland. Engineering, vol. 112, no. 2899, July 15, 1921, pp. 128-129. Chief advantages of bituminous over waterbound macadam are said to arise from superior cementitious qualities, exclusion of water, resiliency, facility and economy. Paper read before Instn. Civ. Engrs.

PAVEMENTS, CONCRETE

Costs, 1921. Standard Costs in Paving. Bul. Associated General Contractors, vol. 12, no. 7, July 1921, pp. 20-26 and 50, 2 figs. Estimate of cost of ideal concrete highway job, 1921. Submitted by committee on education as to costs. Northern Assn. General Contractors.

PAVEMENTS, WOOD-BLOCK

Specifications. Standard Specifications for Wood Block Paving, S. M. Feinberg. Contract Rec., vol. 35, no. 30, July 27, 1921, pp. 694-696. Recommendations based on the suggestions of the principal advocates of wood blocks, coal tar and asphalt after thorough study of the requirements. (Continued.)

Standard Specifications. Standard Specifications for Wood Block Paving, S. M. Feinberg. Contract Rec., vol. 35, no. 29, July 20, 1921, pp. 679-682. Recommendations based on suggestions of principal advocates of wood blocks coal tar and asphalt after thorough study of requirements.

PEAT

Pulverized. Pulverized Peat Fuel a Success, C. L. Bohannan. Jl. Am. Peat Soc. vol. 14, no. 3, July 1921, pp. 19-25. It is claimed that use of pulverized fuel produces a great saving in both fuel and labor costs.

PETROLEUM

Bibliography. Recent Articles on Petroleum and Allied Substances. U.S. Dept. Interior, Report of Investigations, Bur. of Mines, serial no. 2261, June 1921, 28.pp. Bibliography of articles published in first part of 1921.

PILES

Driving of. Notes on Piles (Von Rammpfahl), Joachim Schultze. Beton u. Eisen vol. 20, nos. 2-3 and 4-5, Feb. 4 and Mar. 7, 1921, pp. 29-32 and 55-57, 8 figs. Deals with problem of the varying relations existing between pile and surrounding soil. Earth-pressure formulas applicable to piles.

PIPE, CONCRETE

Advantages. Pipes for Pressure Conduits, Frederic W. Macaulay. Engineering, vol. 112, no. 2899, July 22, 1921, pp. 168-169. Discusses advantages of reinforced-concrete mains. Paper read before Instn. Civ. Engrs.

PISTONS

Machining. Machining Motor Pistons. Machy. (Lond.), vol. 18, no. 458, July 7, 1921, pp. 428-429, 3 figs. Successive steps and equipment employed in machining pistons for high-grade motor car.

PLANERS

Crank-Driven. Results Obtained with Crank-Driven Planers. Machy. (Lond.), vol. 18, no. 458, July 7, 1921, pp. 415-419, 9 figs. Methods of operating machines possessing features of both planer and shaper.

POWER PLANTS

Correction. Power Factor Correction and Its Relation to Plant Operation, P. T. Vanderwaart. Assn. Iron & Steel Elec. Engrs., vol. 3, no. 7, July 1921, pp. 213-231 and Discussion pp. 232-230, 2 figs. Discusses the low power factor, loading motors and transformers, synchronous motors, measurement of power factor, etc.

POWER PLANTS

Generating Costs. Generating Costs in Stations of Medium Size, M. J. Blad. Elec. World, vol. 78, no. 4, July 23, 1921, pp. 169-170. Southern Station burning Mexican fuel oil averages $1. 37 cents per kw-hr ; another station with river washery coal averages $1 24.

Glasgow, Scotland. Dalmarnock Power Station, R. B. Mitchell. Elec. Ry. & Tramway Jl., vol. 44, no. 10, June 10, 1921, pp. 261-271, 26 figs. Describes Glasgow plant completed in 1920. Summary of important data concerning boilers, turbo-alternators condensing plant, motors driving auxiliaries, alternators, set-up transformers and switchgear.

PRESSES

Design. Designing Power Press Frames. Eng. Prod., vol. 3, no. 43, July 28, 1921, pp. 76-78, 2 figs. Data for determining the leading dimensions.

PUBLIC UTILITIES

Rates for Service. Establishing rates for Service Rendered by Public Utilities by Contract, Walter A. Shaw. Jl. Am. Water Wks., vol. 8, no. 4, July 1921, pp. 321-336. Discusses the acts passed by the Illinois Legislature and appeals before the Illinois Supreme Court.

PULVERIZED COAL

Foundries. Powdered Coal Applied in Foundry, A. J. Grindle. Foundry, vol. 49, no. 15, August 1, 1921, pp. 617-618. Layout and operation of a powdered coal installation.

Properties. Powdered Fuel, Robert James. Proc. South Wales Inst. Engrs., vol. 37, no. 3, July 7, 1921, pp. 221-236. Continuation of the discussion of Robert James' paper.

Steam Generation. Pulverized Firing in Steam Generation, F. J. Crolius. Blast Furnace and Steel Plant, vol. 9, no. 7, July 1921, pp. 453-460. Discusses use of pulverized coal. Typical layout of successfully operated plant.

Steel Works. The Adaptability of Pulverized Coal Furnaces for Iron and Steel Works (Anwendbarkeit der Kohlenstaubfeuerung in Eisenhüttenwerken), G. Bulle. Stahl u. Eisen, vol. 41, no. 29,July 21, 1921, pp. 985-994, 6 figs. Advantages of firing with pulverized coal from technical and economic standpoint.

PUMPS

Boiler Feed. Water and Air Pumps for Small Deliveries with Eccentric Drive (Wasser und Ruũtpumpe für geringe Fördermengen mit Antrieb durch Exzenter), H. Mitusch. Fördertechnik u. Frachtverkehr, vol. 14, no. 3, Feb. 4, 1921, pp. 33-34, 5 figs. Description and illustrations demonstrating arrangement of pumps with eccentric drive for use where crank drive is expedient.

PUMPS, CENTRIFUGAL

Reciprocating Pumping Engines vs. Comparison between Reciprocating Pumping Engines and Turbo-driven Centrifugal Pumps, Hugh Lupton. Engineering, vol. 112, no. 2897, July 8, 1921, pp. 74-76. Includes tables showing consumptions and costs of triple-expansion pumping engines and steam turbine-driven centrifugal pumps. Paper read before Instn. Civ. Engrs.

PUNCHES

Design. The Design and Construction of Press Tools—X. Eng. Production, vol. 3, no. 42, July 21, 1921, pp. 56-58, 6 figs. Considers various kinds of punches and dies. (Concluded.)

PYROMETERS

Equipment for. Some Essentials of Modern Pyrometer Equipment, H. G. Hall. Can. Machy., vol. 26, no. 3, July 21, 1921, pp. 38-40, 4 figs. Discusses simplicity of design, cost of thermocouple upkeep, etc.

R

RADIOMETALLOGRAPHY

Spectral Analysis of Metals. Radiometallography (La Radiométallographie), E. Dieudonné. Revue Universelle des Mines, vol. 9, no. 6, June 15, 1921, pp. 557-566, 8 figs. Concludes that by it the spectral analysis of metals has been made possible.

RAILS

Failures. Split-Head Rail Failure Shows Rupture, James E. Howard. Iron Age, vol. 108, no. 7, August 18, 1921, pp. 393-395, 7 figs. Differs from a piped rail and is often more easily discovered by outcropping at side. (Abstract.) Report of Interstate Commerce Commission.

Specifications. A New Rail Specification Proposed, Robert W. Hunt. Iron Age, vol. 108, no. 5, August 4, 1921, pp. 262-263. Provides for rolling tie plates from top of each ingot. Treatment in soaking pits. Lenient as to cold straightening.

Welding. Welding of Rails by Aluminothermic Processes. (La soudure des rails de tramways par les procédés aluminothermiques), M. Guiffart. L'Industrie des Tramways, vol. 15, nos. 171-172, March-April, 1921, pp. 41-47, 9 figs. Practice of French General Company of Tramways.

RAILWAY ELECTRIFICATION

Brazil. Electrification of the Paulista Railway of Brazil, W. D. Bearce. Ry. Age, vol. 71, no. 2, July 9, 1921,pp. 80-83, 5 figs. Fuel scarcity forces the adoption of electric motive power on Brazilian wide gage line.

Switzerland. The St. Gothard Electrification. Elec. Ry. & Tramway Jl., vol. 45, no. 1086, July 8, 1921, pp. 17-20, 6 figs. Has adopted single-phase system, 15 periods, at 7,500-15,000 volts on the contact line. Reasons for this choice are discussed.

RAILWAY OPERATION

Demountable Car Bodies. Speeding up Terminal Operations. Ry. Gaz., vol. 35, no. 5, July, 22, 1921, p. 218, 8 figs. Describes the use of demountable bodies in conjonction with motor chassis to speed up the handling of traffic.

Government vs Private. Government and Private Operation in Canada, J. L. Payne. Ry. Age, vol. 71, no. 3, July 16, 1921, pp. 107-109. Analysis of results obtained on two large railway systems under state and company control.

Heavy-Tonnage. Heavy-Tonnage Train Handling Demonstrations on Virginian. Rd. Herald, vol. 25, no. 8, July 1921, pp. 23-27, 4 figs. Account of series of heavy-tonnage train-handling demonstrations conducted on Virginian R. R. under auspices of Westinghouse Air Brake Co., which successfully illustrated feasibility of handling trains approximating 16,000 tons gross behind locomotive even when undertaking involves long descending mountain grades.

Locomotive Fuel-Oil Stations. Design and Operation of Locomotive Fuel Oil Stations. Eng. News-Rec., vol. 87, no. 5, August 4. 1921, pp. 183-187, 9 figs. Tank cars discharge into track troughs; storage and service tanks; gravity of pumped supply to engines; oil columns; fire protection.

Train Control. Problems of Automatic Train Control. Ry. Gaz. vol. 35, no. 3, July 15, 1921, pp. 121-125. Discusses questions in connection with the prevention of accidents.

The Train Control System of the Midland Railway. Ry. Gaz., vol. 35, no. 2, July 8, 1921, pp. 45-97, 72 figs. partly on supp. plates. Comprehensive review of successful scheme of traffic in which all train-operating arrangements are centralized. Outstanding feature of scheme is said to be its simplicity. Includes figures indicating running efficiency secured by means of control system.

RAILWAY SHOPS

Power and Light for. Electric Power and Light for Railroad Shops, J. E. Gardner. Ry. Mech. Engr., vol. 95, no. 8, August 1921, pp. 515-518, 1 fig. Trend of development and standards adopted in the power and lighting field.

RAILWAY SIGNALING

Alternating Current. Principles of Alternating Current Signaling, J. S. Holliday. Ry. Signal Engr., vol. 14, no. 7, July 1921, pp. 267-269, 3 figs. Vector combinations and solutions of resistances of impedances. (Continuation of serial.)

Maintenance of A. C. Signal Apparatus, L. F. Vieillard. Ry. Signal Engr., vol. 14, no. 8, August 1921, pp. 229-302, 3 figs. Discusses relays, impedance bonds, resistances and reactances, transformers, etc. (To be continued.)

Position-Light Signal. The Development of Position-Light Signals, A. H. Rudd. Ry. Signal Engr., vol. 14, no. 7, July 1921, pp. 264-266, 1 fig. Latest design of Pennsylvania Railroad is said to reduce cost of operation and maintenance and promote simplicity and safety.

RAILWAY SWITCHES

Low-Voltage Machines. Switch Operation by Low-Voltage Machines, C. C. Anthony. Ry. Signal Engr., vol. 14, no. 8, August 1921, pp. 313-315, 1 fig. Discusses where these machines are best employed and their advantages.

RAILWAY TRACK

Rail Inclination. Note of Rail Inclination and Standardization of Track Appliances on Railways of France, W. C. Cushing. Bul. Am. Ry. Eng. Assn., vol. 22, no. 235, March 1921, pp. 943-948, 7 figs.

RAINFALL

Run-Off Measurements, and. Report of Committee on Rainfall and Run-Off Measurements. Jl. N. E. Water Works Assn., vol. 35, no. 2, June 1921, pp. 151-163 and (discussion) pp. 183-186, 1 fig. Presents record of stream flow and rainfall. Recommendations.

REFRACTORIES

Rotary Cement Kilns. Refractories for Rotary Cement Kilns, Raymond M. Howe, Cement Mill & Quarry, vol. 19, no. 1, July 5, 1921, pp. 35-36. Service in clinker zone is said to tax refractory materials. Effect of high temperature and changes in temperature. Other materials. Paper read before Portland Cement Assn.

REFRIGERATING MACHINES

Compression. The Compression Refrigerating Machine, Gardner T. Voorhes. Ice & Refrigeration, vol. 61, no. 1, July 1921, p. 23. Gage pressure.

RESEARCH

University. The University and Research, Vernon Kellogg. Chem. Age (N.Y.), vol. 29, no. 7, July 1921, pp. 274-276. Notes on work of Nat. Research Council, and conditions of university research. Paper read at University of Minn.

RETAINING WALLS

Reinforced Concrete. Concrete Slab Retaining Walls (Ueber Winkelstützmauern) A. Ostenfeld. Beton u. Eisen, vol. 20, nos 1 and 2-3, Jan. 1 and Feb. 4, 1921, pp. 11-13, and 38-40, 4 figs. Equations are derived for calculation of earth thrust, including determination of most dangerous gliding surfaces for horizontal and loaded ground surfaces.

RIVETED JOINTS

Design. Principles of Riveted Joint Design, William C. Strott. Boiler Maker, vol. 21, no. 7, July 1921, pp. 191-193 and 212, 6 figs. Discusses types of plates and rivet failures, joint efficiency and calculations involved in determining strength of given riveted seam. (To be continued.)

RIVETING

Gas Rivet Heating. Experience with Gas Rivet Heating in the Pacific Coast, Letson Balliet. Eng. News-Rec., vol. 87, no. 1, July 7, 1921, pp. 21-23. Shipyard results show better rivets and saving of time and cost. Possibilities for structural work.

ROADS, CONCRETE

Construction.. Three Concrete Road Construction Methods Compared. Eng. News-Rec., vol. 87, no. 3, July 21, 1921, pp. 111-113, 1 fig. Comparison of wheel-barrow, central proportioning-plant and central-mixing-plant methods in building 12 mi. of road near Charles City, Iowa. Central plants are shown to be superior to wheelbarrow work.

ROCK DRILLS

Drill Steel. Heat Treatment of Rock Drill Steel. Iron Age, vol. 108, no. 1, July 7, 1921, pp. 7-8. Effect on breakage. Steel giving longest service. Life of steel. Comparison with eyebars.

ROLLING MILLS

Chilled Rolls. Chilled Rolls for Rôlling Mills (Cylindres de Laminoirs en Fonte trempée), Christian Kluytmans. La Fonderie Moderne, no. 4, April 1921, pp. 81-83. Discusses composition, silicon and other content, and tempering.

Modern Practice. Principles of Modern Rolling Practice, E. Cotel. Iron Age, vol. 108, no. 7, August 18, 1921, pp. 396-399, 6 figs. Discussion of great power required for finishing passes. Phenomenon of speed gain (bar acceleration) in rolling. Translated from Montanistische Rundschau.

Roll Design. The Logic of Roll Design, W. H. Melaney, Part IV. Blast Furnace & Steel Plant, vol. 9, no. 8, August 1921, pp. 477-478, 1 fig. Discusses maximum draft of each pass and minimum diameter of roll.

Roll Making. How Steel Mill Rolls Are Made—I, H. E. Diller. Foundry, vol. 49, no. 15, August 1, 1921, pp. 595-601, 10 figs. Description and illustration of process.

ROOF TRUSSES

Design. Basic Principles for the Design of Arched Roof Trusses without Tie Rods (Entwurfsgrundlagen für zweistielige Bogenhallenbinder ohne Zugband), Otto Fröchlich. Beton u. Eisen, vol. 20, no. 2-3, Feb. 4, 1921, pp. 34-38, 7 figs. Tables and calculations supplementing those for arched roof trusses with tie rod developed by author and published in same journal (no. 9-10, 1919).

S

SCIENTIFIC MANAGEMENT

See Industrial Management.

SEAPLANES

Types. Hydroplanes (Les Appareils Marins d'Aviation), Guitton. L'Aéronautique, vol. 3, no. 25, June 1921, pp. 229-231, 1 fig. Describes the Bréguet Caudron, Savoia and Farman types.

SEMI-DIESEL ENGINES

Small Central Stations. Semi-Diesel Engines in Small Central Stations, W. S. Barnes. Power, vol. 54, no. 3, July 19, 1921, pp. 96-97, 2 figs. Describes 250-hp. engine direct-connected to an alternator. Typical log sheet covering 24-hr. period of operation shows remarkably high fuel economy at varying loads as well as over-all economy.

SEWAGE DISPOSAL

Activated Sludge. Activated Sludge Experiments at Bury, (England), Joshua Bolton. Surveyor, vol. 60, no. 1539, July 15, 1921, pp. 49-52. Results of experiments show that activated sludge is extremely fickle and easily upset; more skilled supervision is required than with percolating system; but there are many physical characteristics which may be observed and which are extremely useful in indicating progress.

Baltimore, Md. Nine years' Operation of the Baltimore Sewage-Works, Theodore C. Schaetzle, Eng. News-Rec., vol. 87, nos. 2 and 3, July 14 and 21, 1921, pp. 50-51 and 97-101, 3 figs. Plant comprises bar screens, venturi meters, hydrolytic and separate sludge digestion tanks, Imhoff tanks, sludge-drying beds, revolving screens for tank effluents and sprinkling filters. Costs and revenue.

Bio-Aeration Method. Experimental Work on Sewage Disposal at Sheffield, John Haworth. Surveyor, vol. 6, no. 1538, July 8, 1921, pp. 29-35, 14 figs. Describes the Sheffield bio-aeration plant, consisting of aeration tank, three rotation chambers, three settling tanks, gaging chamber and motorhouses; and points our advantages of bio-aeration methods.

Sludge, De-Watering. De-Watering Sludge, John D. Watson. Engineering, vol 112, no. 2897, July 8, 1921, p. 87. Describes de-watering process used at Birmingham, England, consisting of biological decomposition plus air-drying. Paper read before Inst. Civ. Engrs.

SHAFTS

Critical Speeds. On the Critical Velocity of Shafts (Sulle Velocita Critiche Degli Alberi), Pietro E. Brunelli. L'Industria, vol. 35, no. 12, June 30, 1921, pp. 269-272, 4 figs. Mathematical calculations for various given conditions.

Large, Straightening. Straightening a Large Shaft by the Heat Process, Frank G. Frost. Proc. La. Eng. Soc., vol. 7, no. 2, April 1921, pp. 85-91, 2 figs. Details of straightening a shaft of a vertical Curtiss turbo-generator in a New-Orleans generating station.

SHIP PROPULSION

Diesel-Electric Drive. Diiesel Electric Propulsion, J. B. Bassett. Marine Eng., vol. 26, no. 8, August 1921, pp. 631-633. Discusses most suitable equipment, including auxiliaries.

SLAG

Blast-Furnace. Color Classification of Blast Furnace Slags, Wallace G. Imhoff. Blast Furnace and Steel Plant, vol. 9, no. 7, July 1921, pp. 433-434. Scientific investigation on nature of slag itself; color classification of slags of value to blast-furnace men. (To be continued.)

SPRINGS

Flat. Design of Flat Springs, Joseph Kaye Wood. Am. Mach., vol. 55, no. 2, July 14, 1921, pp. 46-49, 5 figs. Importance of spring criterion" . Derivation of formulas. Triangular-shaped flat springs. Work and resilience in cantilever springs.

Helical. A Chart for the Design of Helical Wire Springs, R. Brooks. Engineering, vol. 112, no. 2900, July 29, 1921, pp. 173-175, 9 figs. Expressions are developed on which diagrams are built up, and from these the complete proportions of a spring to meet any required specification can be determined with practically no calculation.

STANDARDIZATION

Holland. Standardization in Holland (Normung in Holland), Ernst Hijmans. Betrieb, vol. 3, no. 19, June 25, 1921, pp. 582-595, 12 figs. Discussion of fundamental principles underlying standardization in Holland. Examples. of standard sheets.

STEAM TURBINES

Critical Speeds. The Calculation of Critical Speeds. Engineering vol. 112, no. 2896, July 1, 1921, pp. 1-2, 3 figs. Discusses Bauman's rule for critical speed of turbine rotors.

Modern types. Recent Advances in Steam Turbine Design, Gerald Stoney. Elecn., vol. 86, no. 2249, June 24, 1921, pp.774-780, 14 figs. Details of various modern types. Notes on high vacuum difficulties; disadvantages of higher blade speeds; effects of high steam temperature; bending troubles; blading material; advantages of Monel metal; etc.

STEEL

Artificial Seasoning. Artificial Seasoning of Steels, H. J. French. Chem. & Metallurgical Eng., vol. 25, no. 4, July 27, 1921, pp. 155-158. Review of available data on length changes and spontaneous generation of heat in hardened steels, together with results of preliminary experiments on artificial seasoning by different methods of several types of steels used for making limit gages

Cold-Drawn. Production and Uses of Cold-Drawn-Steel, C. E. Bregenzer. Iron Age, vol. 108, no. 3, July 21, 1921, pp. 135-138, 1 fig. Annual output estimated at 900,000 tons. Automobile field largest consumer.

Motor-Valve for. Steel for Internal-Combustion Motor Valves—II, G. Gabriel. Automotive Mfr., vol. 43, no. 3, June 1921, pp. 16-17 and 26-27. Details of various steels tested and results obtained. Enumeration of desirable and undesirable able properties. Kind of steel recommended.

Overstrain. Effect of Overstrain on the Elastic Properties of Steel. Iron & Coal Trades Rev., vol. 103, no. 2785, July 15, 1921, pp. 73, (From R. D. Report No. 45, Research Dept. at Woolwich). Gives a summary of tests carried out with overstrained steels.

Pickling, Effect of. Embrittling Effect of Pickling Upon Carbon Steel, C. J. Morrison. Iron Age, vol. 108, no. 6, Aug. 11, 1921, pp. 334-335, 3 figs. Study of grain sizes shows that pickling increases width of junction lines between grains.

Properties and Microstructure. Properties and Microstructure of Heat Treated Nonmagnetic, Flame, Acids and Rust Resisting Steel, Charles M. Johnson. Trans. Am. Soc. Steel Treating, vol. 1, no. 10, July 1921, pp. 551-576, 17 figs. Describes certain unusual properties of steel produced as result of author's study of steels. Photomicrographs.

Properties at High Temperatures. Investigation of the Mechanical Properties of Steels at High Temperatures (Recherches expérimentales sur les propriétés mécaniques des aciers aux temperatures élevées). Eugène Dupuy. Revue de Métallurgie, vol. 18, no. 6, June 1921, pp. 331-365, 39 figs. Detailed study of fracture and elongation, giving experimental results.

Specifications. Proposed Revised Specifications for Steel Products. Blast Furnace & Steel Plant, vol. 9, no. 8, August 1921, pp. 498-505. Abstract of recent report of committee of American Society for Testing Materials covering steel rails, steel pipe, boiler and superheater tubes.

Tool. The Oxidation of Carbon Tool Steel on Heating in Air, Howard Scott. Chem. & Metallurgical Eng., vol. 25, no. 2, July 13, 1921, pp. 72-74, 9 figs. Results of experiments show that below 850 deg. cent. and for period up to five hours there is no appreciable decarbonization—that is, scaling at least keeps space with decarbonization.

See also Molybdenum Steels; Nickel Steels; Steel, High-Speed; Structural Steel.

STEEL CASTINGS

Centrifugally Cast. Test of Centrifugally Cast Steel, George K. Burgess. Techn. Papers Bur. Stand., no. 192, 22 pp., 9 figs. Six castings were examined as to their physical and chemical properties, showing the possibility of substituting heat treatment for forging in this type of casting.

Green-Sand. Steel Castings Made in Green Sand, W. H. Rocaner. Foundry, vol. 49, no. 14, July 15, 1921, pp. 552-554, 5 figs. When proper precautions are observed steel castings poured in this medium are said to present as pleasing an appearance as any gray iron or malleable castings.

STEEL, HEAT TREATMENT OF

Factors Governing. Factors Governing the Production of Heated Products, J. A. Brown. Trans. Am. Soc. Steel Treating, vol. 1, no. 10, July 1921, pp. 575-587. Summary of factors to be considered.

STEEL, HIGH-SPEED

Manufacture. The Manufacture of High Speed Steel, Felix Kremp. Official Proc. Central Ry. Club, vol. 29, no. 3, May 1921, pp. 1042-1046 and (discussion) pp. 1046-1 51. Details of manufacture.

STREET RAILWAYS

Construction Machinery. Modern Construction Methods and Machinery. Elec. Traction, vol. 17, no. 7, July 1921, pp. 445-448, 17 figs. Notes on machinery used on Chicago surface lines. Three types of mechanical tampers are utilized.

STRUCTURAL STEEL

Plant. Design of Structural Steel Plant of 5000-Ton Capacity, W. D. Coulter. Can. Engr., vol. 41, nos. 2 and 3, July 14 and 21, 1921, pp. 7 and 11 and 9-10, 5 figs. Layout of plant and buildings; types of buildings and equipment.

SUBSTATIONS

Automatic. Automatic Sub-station for Toronto Transportation Commission, H. C. Sutherland. Contract Rec., vol. 35, no. 28, July 13, 1921, pp. 663-665, 4 figs. Design and operating characteristics of 1000-Kw. substation which is first of its type in Canada.

SUPERHEATERS

Marine and Locomotive. Superheaters and Fuel Economy—XII. Machy. Market, no. 1078, July 1, 1921, pp. 21-22, 3 figs. Marine and locomotive superheaters.

Performance. Superheaters and Superheat, A. D. Pratt. Mech. Wld., vol. 70, no. 1803, July 22, 1921, pp. 61-63. Discusses safety-valve equipment, superheater performance and variable combustion conditions.

SWAGING MACHINES

Band-Saw. Swaging and Side-Dressing Machine for Band Saws. Engineering, vol. 112, no. 2900, July 29, 1921, pp. 186 and 188, 9 figs. Machine constructed by A. Ransome & Co., Ld., Newark-on-Trent, England, can deal with saws from 3½ in. to 8 in. wide and with teeth from 1¼ in. to 2½ in. pitch. It is entirely automatic in operation and works at rate of 20 teeth a minute.

T

TAR OILS

Low Temperature. Uses for Low-Temperature Tar Oils, J. P. Coffin. Gas Age-Rec., vol. 48, no. 3, August 6, 1921, pp. 97-100, 5 figs. Considers creosote and light motor fuel oils.

TEMPERATURE MEASUREMENT

Instruments for. The Measurement of Temperature—XII. P. Field Foster. Mech. World, vol. 70, no. 1801, July 8, 1921, pp. 32-33, 6 figs. Details of Carpenter-Stansfield deflection potentiometer; and thermocouple indicator made by Foster Instrument Co. Describes several industrial applications of thermocouple pyrometers and methods of mounting. (Continuation of serial.)

TESTING MACHINES

Bar. Testing Machine Helps, R. W. Allard. Iron Age, vol. 108, no. 2, July 11, 1921, p. 87, 1 fig. Compiling table to translate pounds on test bar into pounds per square inch.

Brinell Hardness. The Brinell Test. Machy. (Lond.), vol. 18, no. 459, July 14, 1921, pp. 459-461, 3 figs. Describes two new machines, a power-operated hardness and a small ball hardness testing machine.

TEXTILE MILLS

Steam Plant. The Hamilton Plant of the Canadian Cottons Ltd., T. H. Fenner. Power House, vol. 14, no. 14, July 20, 1921, pp. 21-25, 7 figs. Steam plant installed to supply steam for process work and heating.

Ventilation. The Ventilation and Humidification of Textile Factories, H. N. Leask. Engineering, vol. 112, no. 2900, July 29, 1921, pp. 202-204, 2 figs. Describes apparatus designed by A. B. Cleworth to meet all requirements of constancy of humidity and ventilation, etc. Presents chart showing average monthly temperature in weaving shed. Paper read before Rochdale Cotton Spinners' Mutual Improvment Soc.

THERMIT WELDING

Pipe Joints. Thermit Welded Pipe Joints, R. L. Browne. A.S.R.E. Jl., vol. 7, no. 6, May 1921, pp. 452-457, and (Discussion), pp. 457-459, 4 figs. Gives results of tensile and bursting tests, and vibration tests.

TIMBER

Waste Elimination. Industrial Timber Research Abroad and In South Africa. Nils B. Eckbo. So. African Jl., Ind., vol. 4, no. 6, July 1921, pp. 534-539, 6 figs. Concentrates on elimination of wastes and improved utilization of forest products.

TIME STUDY

Watch for. Time Study Watch That Records Number of Operations Performed in One Hour. Coal Age, vol. 20, no. 2, July 14, 1921, p. 52, 1 fig. Describes new duration time-study watch for timing, analysis and observation of from one to ten operations up to including five minutes of duration.

TIRES, RUBBER

Durability. Determining Factors for the Life of a Pneumatic Tire, William G. Nelson. Chem. & Metallurgical Eng., vol. 25, no. 4, July 27, 1921, pp. 153-154. Discusses five factors, namely, rubber and compounding materials, fabric, construction, vulcanization and usage. Causes for premature failures of tires.

Fabric for. A Brief Analysis of Tire Fabric Manufacture, H. R. Whitehead. India Rubber World, vol. 64, no. 5, August 1, 1921, pp. 814-816, 10 figs. Discusses picking, carding, combing, drawing, slubbing, warping and twisting, weaving.

Pneumatic. Dynamic Balance and Construction of the Pneumatic Tire, William Roberts. India Rubber World, vol. 64, no. 5, August 1, 1921, pp. 811-813, 9 figs. Considers variables in tire construction, proper bead location, assembling threads and gives a formula for figuring weight of cured and uncured thread.

TOOLROOMS

Pudget Sound Navy Yard. Caring for Tools at Puget Sound Navy Yard. Am. Mach., vol. 55, no. 3, July 21, 1921, pp. 94-96, 7 figs. Central tool-grinding room. Novel system of sliding racks for storing milling cutters. Cleansing and lubricating pneumatic tools.

TRACTORS

Caterpillar. Tractors in the Oil Fields, Earle W. Gage. Oil Field Eng., vol. 23, no. 7, July 1921 pp. 66, 1 fig. Gives particulars of successful application of caterpillar type of tractor.

Lubrication. Tractor Lubrication, J. W. Stack. Part—II. Sci. Lubrification, vol. 1, no. 6, June 1921, pp. 9-14, 12 figs. Discusses lubrification as applied to internal-combustion-motor propelled units, (Concluded.)

TRAILERS

Clay-Products Industry. Use of Trailers Saves Motive Power, Gilbert I. Stodola. Brick & Clay Rec., vol. 59, no. 1, July 12, 1921, pp. 35-38, 6 figs. Application of trailer and semi-trailer in clay-products industry for distribution of clay ware.

TRANSFORMERS

Voltage. Voltage Transformers, E. G. Reed. Elec. Jl., vol. 18, no. 7, July 1921, pp. 321-329, 14 figs. Deals with question of voltage ratio, and to time phase relation of primary impressed and secondary delivered voltages, under various conditions of load.

TRUSSES

Stress Determination. Theory of Structures, Ernest W. Dibley. Commonwealth Engr., vol. 8, no. 11, June 1, 1921, pp. 328-329, 9 figs. Describes a method for determinig by inspection the nature of stresses in the members of trusses for dead and uniformly distributed live loads.

TUBES

Seamless. On the manufacture of Seamless Tubes—IV, Karl Gruber. Blast Furnace and Steel Plant, vol. 9, no. 7, July 1921, pp. 442-444, 6 figs. Seamless tube rolling in Germany with special consideration of Mannesman pilgrim-step rolling mill.

U

U.S. BUREAU OF STANDARDS

War Work. War Work of the Bureau of Standards, U.S. Dept. of Commerce Bur. of Standards, no. 46, April 1, 1921, 299 pp. 35 figs. Short descriptions of more important work carried on during the war which was of direct service to military forces. Deals, with aeronautic instruments and power plants; aircraft construction, materials, etc.; chemical investigations; coke-oven investigations; concrete ships; electric batteries; electric tractors and trucks; precision gages; illuminating engineering; invisible signaling; magnetic investigations; metallurgical investigations; natural-gas investigations; optical glass and instrument; protective coatings; radio communication; radium; rubber; searchlights; sound-ranging apparatus; wheels; X-rays, etc.

V

VIBRATION

Measurement. Measurement of Vibration of the 660-ft. Wireless Telegraph Station Tower at Haranomachi, F. Omori. Engineering vol. 112, no. 2900, July 29, 1921, pp. 196-199, 13 figs. Results of measurement of movement of tower caused by winds, carried on during course and after completion of construction on five different occasions.

VISCOSITY

Effect on Orifice Flows. The Effect of Viscosity on Orifice Flows. W. N. Bond. Physical Soc. Lond. Proc., vol. 33, part 4, June 15, 1921, pp. 225-230, 2 figs. Results of determinations are plotted in manner which combines both purely viscous and purely turbulent flows in one graph. It is shown that effect of slight viscosity is to increase coefficient of discharge.

W

WAGES

Incentive vs Production Basis. Incentive of Production Basis of Wage Payment —I and II, Henry Farquhar. Am. Mach., vol. 55, nos 5 and 7, August 4 and 18, 1921, pp. 169-172 and 275-277, 1 fig. Aug. 4: Constructive preparation necessary; effect of working conditions on mental attitude; elements of scientific management; determining standard production time. Aug. 18: Reward for standard accomplishment; variations in types of incentive; aristocracy of skilled labor; individual and group reward.

Wage-Level Formula. Past and Future Wage Levels, Halbert P. Gillette. Eng. & Contracting, vol. 56, no. 5, August 3, 1921, pp. 97-101, 2 figs. Develops a wage level formula for which he concludes that during the past years the per capita bank deposits have increased twice as rapidly as per capita money.

WASTE HEAT

Utilization. The Utilization of Waste Heat in Gasworks, George E. Stewart. Engineering, vol. 112, no. 2897, July 8, 1921, pp. 77-78. Notes on carbonization water gas manufacture, and waste heat boilers. Paper read before Instn. Civ. Engrs,

WATER

Viscosity. Viscosity of Water at Low Rates of Shear, Albert Griffiths. Physical Soc. Lond. Proc., vol. 33, part 4, June 15, 1921, pp. 231-242, 4 figs. Determination by method in which water is forced along glass capillary tubes of about 1.5 to 2 mm. bore at rates of flow varying from 1 liter in two years to 1 liter in 24 years.

WATER METERS

Standard Specifications. Report of the Joint Committee on Standard Specifications for Water Meters. Jl. N. E. Water Works Assn., vol. 35, no. 2, June 1921, pp. 187-196. Standard Specifications for cold-water meters, disc type; equipment necessary to test meters; tests of meters recommended; etc.

WATER POWER

Canada. Available Water Power in Canada. Can. Engr., vol. 41, no. 1, July 7, 1921, p. 1, Figures recently compiled by Dominion water power branch.

Development. Water Power Development, W. E. Williams. Beama, vol. 9, no. 1, July 1921, pp. 19-24, 7 figs. Notes on survey of a catchment area; artificial reservoirs; and linking up of hydroelectric stations.

WATER SOFTENING

Cold Lime-Soda Process. Water Softening by the Cold Lime-Soda Process, George C. Cook. Power, vol. 54, no. 3, July 19, 1921, pp. 92-94. How boiler priming and scale formation may be prevented by simple chemical treatment. How to conduct tests for causticity and alkalinity in feedwater.

WATER SUPPLY

Installations. The Economic Choice Between Permanent and Temporary Installations Where Requirements Are Permanent, Temporary, Changing or Uncertain, John Cecil Black. Eng. & Contracting, vol. 56, no. 2, July 13, 1921, pp. 30-32. Method for definite determination of proper installation.

WATER TANKS

Elevated. Auxiliary Equipment for Elevated Water Tanks, Charles L. Hubbard. Power Plant Engr., vol. 25, no. 14, July 15, 1921, pp. 703-706, 8 figs. Methods employed to prevent the freezing of water tanks and riser.

WATER TREATMENT

Small Municipalities, for. Water Treatment for Small Municipalities, E. M. Partridge. Mun. & County Eng., vol. 61, no. 1, July 1921, pp. 23-26. Notes on various water-treatment processes.

WELDING

See Autogenous Welding; Electric Welding; Electric Welding Arc; Fusion Welding; Oxy-acetylene Welding; Thermit Welding.

WELFARE WORK

Employees' Mutual Benefit Associations. Mutual Benefit Associations in Industry, Frederick A. Anderson. Power Plant Eng., vol. 25, no. 16, August 15, 1921, pp. 798-802, 3 figs. Outlines the principles on which such an organization should be organized.

WINDING ENGINES

Graphical Dynamics. The Graphical Dynamics of a Winding Engine—I, Charles D. Mottram. Colliery Guardian, vol. 121, no. 3155, June 17, 1921, pp. 1733-1734, 8 fig., and vol. 122, no. 3157, July 1, 1921, p. 30, 3 figs. Apportionment of external losses in a large steam winding engine at Yorkshire Main Colliery, Doncaster. Determination of hp. developed in raising load only; hp. expended in wind resistance.

Modern. Modern Winding Engines—IX, M. Corliss. Mech. World., vol. 70, no. 1801, July 8, 1921, pp. 29-30. Brake gears. (Continuation of serial.)

Engineering Index

This Index is prepared by the American Society of Mechanical Engineers.

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A

ACCIDENTS

INDUSTRIAL. Accidents in Factories and Workshops. Chem. Age., vol 5, no. 112 August 6, 1921, pp. 156-158. Notes on dangers in machinery and processes from annual report of British chief factory inspector.

AEROPLANES

BRACING INTERNAL. The Internal Bracing of Aeroplane Wings, A. H. Staurt. Engineering, vol. 112, no 2904, Aug. 26, 1921, pp 301-302, 5 figs. Results of experiments for obtaining suitable data regarding initial tension to be put upon internal bracing wires of wings.

RIESELER. The New Rieseler Sport Monoplane (Das neue kleine Rieseler-Sportflugzeug), E. Meyer. Motorwagen, vol. 24, no. 20, July 20, 1921, pp. 411-414, 4 figs. Characteristics: Span, 7 m.; total length, 5.8 m.; weight empty, 150 kg.; engine, 30-hp. Haacke; speed, 110 km. per hr. Discusses requirements of a sport aeroplane.

10-Seater Tractor Biplane. Single-Engined Ten-Seater Tractor Biplane Engineer, vol. 132, no. 3420, July 15, 1921, p. 73, 1 fig. Built by Bristol Aeroplane Co., Ltd., Bristol, England, Span, 54 ft. ; length overall, 42 ft. ; height, 11 ft.; speed at ground level, 122 mi. per hr. ; ceiling, 13,500 ft.

AIR COMPRESSORS

EXPLOSIONS .What Causes Explosions in Air Compressors?, A. D. Risteen. Can. Machy., vol. 26, no. 6, August 11, 1921, pp. 35-36. Discusses carbonization of oil, ignition of carbon and removal of carbon and oil deposits.

GERMAN TYPES. Compressors (Kompressoren). Schiffbau, vol. 22, no. 42, July 20, 1921, pp. 1040-1043. 5 figs. Notes on Koster's valve gear, single-stage compressors; single-cylinder stage compressor for suction pipes up to 2000 cu. m. output per hr.; tandem compound compressors for suction pipes from 2500 to 5000 output per hr.; and high-speed compressors, built by Frankfort Machine Constr. Corp., Germany.

HIGH-PRESSURE. A New Design of High-Pressure Compressors. Practical Engr., vol. 64, no. 1795, July 21, 1921, pp. 40-41, 5 figs. Describes Reavell "Axial" single-stage air compressor.

LUBRICATION. Avoiding Compressor Troubles, A. D. Risteen. Iron Trade Rev., vol. 69, no. 8, Aug. 25, 1921, pp. 489-492 and 495. Lubrication is said to be factor, and oil must have suitable properties. Explosions of external and internal origin can be prevented by cleaning accumulations periodically. Compressors usually over-lubricated.

REAVELL QUADRUPLEX The Reavell Quadruplex Air Compressor and Some Tests Thereon Engineer, vol 132, no 3421, July 22, 1921, pp. 98-100, 9 figs. Report of tests made by H Riall Sankey on 1920 design.

ALLOY STEELS

Electric. Three Types of Alloy Sheet Steel—I Horace C. Kneer. Iron Age, vol. 108, no. 10 Sept 8, 1921, pp 594-596, 2 figs. Deals with investigation of three commercial types of high-strength alloy steel in sheet form, carried out at Naval Aircraft Factory, Philadelphia, to determine which was most suitable for manufacture of fittings for large aircraft.

ALUMINUM

Welding. Oxy-Acetylene Welding Cast and Sheet Aluminum. Can. Machy., vol. 26, no. 4, July 28, 1921, pp. 31-32 and 35. Describes various operations involved.

ALUMINUM ALLOYS

See Duralumin.

AUTOMOBILE ENGINES

Intake Manifolding. Intake Manifolding. Motor Age. vol. 40, no. 7, August 18, 1921, pp. 14-15, 13 figs. Multi-cylinder manifolding as applied to six-cylinder engines.

Lapping Machines for Bearings. Lapping and Running-in Machine, A. B. Bassoff. Machy. (N Y) vol. 28, no. 1, Sept. 1921, pp. 5-7, 4 figs. Function of lapping machine. Design of oscillating and of reciprocating mechanism. Types of work lapped.

Grand Prix, 1921. Prize Competition of the Automobile Club of France (Le Grand-Prix de l'Automobile-Club de France en 1921). Le Génie Civil, vol. 79, no. 6, August 6, 1921, pp. 121-124, 7 figs Data on the course, and motors and motorcycles competing.

Headlights. Motor Car Headlights: Ideal Requirements and Practical Solutions, A. Garrard Illuminating Engr., vol. 14, no. 4, April 1921, pp. 92-102 and Discussion pp. 102-107, 5 figs. Discusses effect of dazzling light on eyes and defines in general terms desirable characteristics of a non-dazzle headlight.

AVIATION

Civil. Aviation and Transport, F. H. Sykes. Jl. Inst. of Transport, vol. 2, no. 5, March 1921, pp. 208-216 and Discussion pp. 216-218. Discusses military and commercial importance of developing civil aviation.

B

BALANCING

Principles. Four Years of Balancing Practice, N. W. Akimoff. Eng. & Ind. Management, vol. 6, no. 5, August 4, 1921, pp. 116-118, 4 figs. Describes principles of static and dynamic balance.

BEAMS

Reinforced-Concrete. Reinforced-concrete Beams—III, T. C. Broom. Mech. Wld., vol. 52, no. 1805, August 5, 1921, pp. 108, 1 fig. Discusses chart for concrete T-beam with single reinforcement. (Concluded).

Unsymmetrical Sections. Calculating the Strength of Unsymmetrical Sections. Machinery (Lond.), vol. 18, no. 463, August 11, 1921, pp. 575-577, 2 figs. Two methods of determining moment of inertia, together with formulas for obtaining section modulus and radius of gyration.

BEARINGS

Spherical. Boring Sperical Bearing Housing, J. Blakey and J. Shamkey. Mech. Wld., vol. 52, no 1805, August 5, 1921, pp. 98, 2 figs. Describes economical method of boring spherical bearing housing for shaft connection between gear box and differential gear of heavy motor transport.

BEARINGS, BALL

Friction. The Ball Bearing: In the Making, Under Test, and On Service, Henry L. Heathcote. Mech. Wld., vol. 70, nos. 1804 and 1807, July 29 and Aug. 19, 1921, pp. 79-81, 4 figs., and 140-141, 2 figs. Discusses questions of friction due to slip, position of non-slip bands, internal stresses due to alternating load. Friction and heat at contact surfaces of ball and race ways of a thrust washer. Paper before Instn. Automobile Engrs. (To be continued.)

BOILER EXPLOSIONS

Hydraulic tests as Safeguard. The Value of Hydraulic Tests as a Safeguard Against Explosions. C. E. Stromeyer. Eng. & Indus. Management, vol. 6, no. 7, Aug. 18, 1921, pp. 170-173. (Abstract.) Annual memorandum of Manchester Steam Users' Assn. Analysis of all reported boiler explosions and conclusions therefrom.

BOILER FEEDWATER

Distilled. Economical Production of Distilled Feedwater for Power Station Boilers (Production économique de l'eau distillée pour l'alimentation des chaudières dans les centrales thermiques). M. Lebard. Chaleur et Industrie, vol 2, no. 15, July 1921, pp. 402-404 and Discussion pp. 405. Describes system specially studied. Discusses first cost and saving effected.

Regulators. Scientific Boiler Feed Water Regulation. Can it be attained in Pratice?, Roland Moeller. Am. Mar. Engr., vol. 16, no. 11, June 1921, pp. 30-33, 6 figs. Discusses operations of boiler-feed regulators and their adaptation to demand for steam.

BOILER FIRING

Draft Systems. Natural v. Mechanical Draught for Boiler Plants—I, J. W. Rogers. Mech. Wld., vol. 70, no. 1804, July 29, 1920, pp. 81-82. Discusses natural-draft, induced-draft and forced-draft systems (To be continued.)

Oil-Fired Boilers. Oil Fuel for Boilers Viewed as a Permanent Institution. Mech. Wld., vol. 52, no. 1806 August 12, 1921, pp. 125-126, 3 figs. Discusses salient features necessary for success of oil-fuel application.

BOILER OPERATION

Control. Boiler Control and apparatus Therefor (Le Contrôle de la Chauffe des Appareils de Mesure Servant à ce Contrôle). Paul Frion. Bulletin de la Société d'Encouragement pour l'Industrie Nationale, vol. 133, no. 6, June 1921, pp. 553-575. Discusses heat balances and various measuring devices to make best possible use of fuel.

Steam-Jet Draft. Calculating a Steam Jet for the Draft of a Boiler (Calcul d'Une Trompe à Vapeur Pour Tirage de Foyer de Générateur, G. Rollet. Arts et Métiers, vol. 74, no. 7, April 1921, pp. 107-113, 6 figs. Explains principle and shows how to calculate maximum efficiency.

Steam Raising. Steam Raising, David Wilson. Elec. Rev., (Lond.) vol. 89, no. 2280, August 5, 1921, pp. 195-196. Discusses efficiency, liquid fuel, air heaters etc. (Abstract.) Paper read before Incorporated Mun. Elec. Assn.

BOILERS

Electrically Heated. Electric Steam Generators Automatically Controlled (Générateurs Électriques de Vapeur à Régulateur Automatique de Production), J. Besson-Grange. Arts et Métiers, vol. 74, no. 7, April 1921, pp. 114-116, 3 figs. Description of an electric boiler.

BRIDGE DESIGN

Modern. Recent Bridge Constructions. (Der Brückenbau der neusten Zeit), A. Mullenhoff. Zeit. des Vereines deutscher Ingenieure, vol. 65, nos. 31 and 32, July 30 and Aug. 6, 1921, pp. 815-820 and 844-847, 20 figs. Extracts from most important publications in 1919 and part of 1918 on bridge construction, including recent constructions in Germany, Switzerland, France, United States. Different opinions with regard to stresses in compression members and use of bolts instead of rivets. Notes on new French and Swedish bridge regulations. French, English and American military bridge systems.

BRIDGE ERECTION

Girder spans, erecting. How to handle and Erect Girder Spans Without Special Equipment -III. Public Works, vol. 51, no. 6, Aug. 6, 1921, pp. 116-118, 3 figs. With fixed and movable derricks.

BROACHES

Design. Practical Design of Broaches, C. S. Pettit. Machinery, (Lond.) vol. 18, no. 462, August 4 ,1921, pp. 538-541, 5 figs.

Theoretical Design of Broaches, C. S. Pettit. Machinery, (Lond.), vol. 18, no. 464, August 18, 1921, pp. 602-603, 3 figs. Discusses construction of a broach tooth.

C

CABLES, ELECTRIC

Submarine. Submarine Cable Test, J. Rymer-Jones. Elec. Rev. (Lond.) vol. 89, no. 2280, August 5, 1921, pp. 172. Discusses methods of measuring the C. R. and D. R. of a aid submarine cable while subjected to earth or tramway currents.

CASE-HARDENING

Compounds. Carbonizing and Carbonizing Materials, H. B. Knowlton. Trans. Am. Soc. For Steel Treating, vol. 1, no. 11, August 1921, pp. 689-698. Discusses case-hardening and case-hardening compounds.

CEMENT

Bulk. An Investigation into the Use of Bulk Cement. Eng. News-Rec., vol. 87, no. 8, Aug. 25, 1921, pp. 324-326. Discussion of its use on large concrete building jobs, prepared by staff of Turner Constr. Co., New York City.

CEMENT MANUFACTURE

Rotary-Grate Shaft Kilns. The Automatic Rotary-Grate Shaft Kiln, C. F. Hansen. Rock Products, vol. 24, no. 18, Aug. 27, 1921, pp. 33-40, 14 figs. How European portland-cement manfacturers are meeting rapidly increasing fuel and labor costs. Summarizes savings in cement plant with yearly output of 300,000 bbl. in using rotary-grate shaft kilns instead of rotary kiln.

CHUCKS

Magnetic Chucks-IX, Ellsworth Sheldon. Am. Mach., vol. 55. no. 10, Sept. 8, 1921, pp. 383-386, 7 figs. Supporting pieces of irregular shape on a magnetic chuck. Testing a chuck to determine its class.

COAL

Carbonization. The Carbonization of Coal at Low Temperature. John Roberts. Iron & Coal Trades. Rev., vol. 103, no. 2789 August 12, 1921, pp. 193-196. and Discussion pp. 196. Discusses expansion of coal and its prevention, dealing with swelled coal; essentials of good semi-coke, etc. Paper read before North of Eng. Inst. Min. & Mech. Engrs.

Preparation. Advances in Preparation of Anthracite, Dever C. Ashmead. Min. & Metallurgy, no. 177, Sept. 1921, pp. 47-48'. History of development. Investigation of five methods of cleaning anthracite. (Abstract.) Paper before Am. Inst. Min. & Metallurgical Engrs.

COAL DUST

Inflammability. Result of investigations at Lievin into the Inflammability of Coal Dusts (Les Résultats des Recherches de Lievin sur les Inflammations de Poussières), E. Audibert. Annales des Mines, vol. 12, S. 11, July 1921, pp. 5-78. Discusses mechanics of explosions, influence of dusty deposits in propagating them, and measures to prevent dangers from coal dusts.

COAL MINES

Shaft Lining. Lining a Shaft with Concrete and Gunite Without Interfering with Operation, R. H. Gillespie. Coal Age, vol. 20, no. 8, August 25. 1921, pp. 287-290, 5 figs. Concrete was machine-mixed and lowered in wheelbarrows. During part of guniting operation gun was located on the surface and during rest of work operated in upper coal bed.

COAL MINING

Mechanical. Mechanical Mining of Anthracite, Herbert D. Kynor. Min. & Metallurgy, no. 177, Sept. 1921, pp. 43-44, 1 fig. Describes machines and methods of using them. Statistics concerning different methods. (Abstract.) Paper before Am. Inst. Min. & Metallurgical Engrs.

COAL WASHING

Processes. Modern Coal Washing (La Technique Moderne du Lavage des Charbons), C. Berthelot. Chaleur & Industrie, vol. 2, no. 15, July 1921, pp. 393-401. 8 figs. Discusses importance of coal washing from economical standpoint and describes processes and apparatus for the purpose. (To be continued.)

COFFERDAMS

Steel-Pile. Fence of Wire Cloth Retains Hydraulic Fill, R. R. Lundahl. Eng. News-Rec., vol. 87, no. 8, Aug. 25, 1921, pp. 317, 3 figs. Steel pile cofferdam, 900 by 750 ft., built within 1000 by 918-ft. bulkhead for Milwaukee sewage works.

COKE

Blast-Furnace. Characteristics of Blast Furnace Coke (Sur les Caractéristiques du Coke de Haut-Fourneau), Pierre Kersten. Revue Universelle des Mines. vol. 10, no. 1, Series 6, July 1, 1921, pp. 27-34. Describes physical and chemical properties. (To be continued.)

COLLOIDS

Removal from Sewage. Relation of Colloid Chemistry to Tank Treatment of Sewage, F. W. Mohlman. and Langdon Pearse. Eng. & Constracting' vol. 56, no. 6, Aug. 10, 1921. pp. 134-135, 1 fig. Summary of work done and methods used in determination of colloid with suggestions as to their standardization, and review of results of processes for removal of colloids of sewage.

COLUMNS

Eccentric Loading. Eccentric Loading of Bars and Columns, Edward Ingham. Practical Engr., vol 64, no. 1795, July 21, 1921, pp 39-40. Discusses formulas for calculating stresses on eccentrically loaded columns.

Pipe. Strength of Pipes as Columns, John S. Watts. Am. Mach vol 55, no 9, Sept 1, 1921, p. 341, 1 fig. Presents chart for calculating size of pipe necessary to support a given load as a column of given length.

COMBUSTION

Control. Controlling Conbustion on Basis of CO_2 Alone Unsatisfactory. Am. Mar. Engr., vol 16, no. 11, June 1921, pp. 35-41, 4 figs. Discusses essentials in attainment of maximum economy in combusion control. (To be continued.)

COMPASSES

Aerial Navigation. Compass for Aerial Navigation (Le Compas de Navigation Aérienne). L. Condroyer. L'Aeronautique, vol. 1, no 8, February 1920, pp 387-395, 20 figs. Describes Kelvin, Greach-Osborne and A. M.-1 Compasses.

Gyrostatic. The Anschütz and Sperry Gyrostatic Compasses (Sur les compas gyrostatiques Auschütz et Sperry), H. Beghin. Comptes rendus de l'Académie des Sciences, vol 173, no. 5, August 1, 1921, pp. 288-290. Discusses equations governing their small oscillations.

CONCRETE

Centrifugally Cast. Centrifugal Machine Casts Solid Concrete Shapes, Leon Cammen. Eng. News-Rec., vol. 87, no. 9, Sept. 1, 1921, p. 366, 1 fig. Describes machine for centrifugal casting of solid concrete shapes patented by Cammen Laboratorieas, New York,.

Disintegration in Alkali Soils. The Disintegration of Concrete in Alkali Soils, G. M. Williams. Jl. Eng. Inst. Can., vol. 4, no. 8, Aug. 1921., pp. 446-455, 8 figs. Summary of results of laboratory studies together with details of Bur. of Standards field investigations.

Specifications. Tentitave Specifications for Concrete and Reinforced Concrete. Proc. Am. Soc. Civ. Engrs., vol. 47, no. 6, Aug. 1921, pp. 60-121, 18 figs. Peport of joint committee on standard specifications for concrete and reinforced concrete. Notes on proportioning and mixing, and depositing concrete forms; details of constructions; water-proofing and protective treatment; surface finish; and design.

Strength. Effect of Age on Strength of Concrete, Duff A. Abrams. Mun. & County Eng., vol. 61, no. 2, August 1921, pp. 47-49, 2 figs. Defends view that concrete does not decrease in strength with age.

CONCRETE REINFORCED

Sea Water, Use in. The Use of Reinforced-Concrete in or Near Sea Water, Artbur S. Tuttle. Mun. Engrs. Jl., vol. 7, 2nd quarterly issue, 1921, pp. 66-84. Suggests rules to ensure reliable results with reinforced concrete in sea water. Reprint of report to Board of Estimate and Apportionment of N. Y. C.

CONDENSERS, STEAM

Leakage Detection. Simplified Chemical Method of Detecting Surface Condenser Leakage, W. E. Caldwell. Power, vol. 54, no. 4, July 26, 1921, pp. 141-142, 1 fig. Tells how to make up solutions for estimating amount of leakage of raw water into condenser.

The Electrical Method of Detecting Surface Condenser Leakage, W. E. Caldwell. Power, vol. 54, no. 6, Aug. 9, 1921, pp. 217-219, 7 figs. Method of obtaining continuous graphic record of leakage by measuring and recording electrical conductivity of condensate.

Surface. Marine Surface Condensers and Condenser Auxiliaries. Am. Mar. Engr., vol. 16, nos. 10 and 11, May and June 1921, pp. 28-33, 6 figs., and 23-27, 17 figs. May: Contains diagrams showing theoretical ratio of injection water of steam for different vacua and water temperature, also maximum permissible air leakage for different sizes of marine turbine and reciprocating engine condensing plants. June: Discusses live-steam, back-pressure and condensate pumps.

Recent Improvements in Condensers for Steam Engines (Recents perfectionnements des appareils de condensation des machines à vapeur d'eau), L. Jauch. Chaleur et Industrie, vol. 2, no 15, July 1921, pp. 416-418, 1 fig. Discusses surface condensers, including Brown-Boveri type. (To be continued.)

CONNECTING RODS

Aluminum. Aluminum Connecting Rods (Bielles en Aluminium). A. Dat. Arts et Métiers vol. 74, no. 8, May 1921, pp. 141-144, 9 figs. Details of construction alloys suitable, etc.

Machining Automobile. Milling Automobile Connecting-rods, J. M Henry. Machy. (N. Y.), vol. 27, no. 12, Aug. 1921, pp. 1104-1105, 4 figs. Equipment and methods used in machining Chevrolet, Hinkley and Duesenberg connecting rods.

CONVEYORS

Belt. Belt Conveyor System in Chicago's New Parcel-Post Station. Belting vol. 19, no. 2, August 1921, pp. 17-20, 4 figs. Eighteen conveyors, compactly arranged in tiers, afford quick and efficient separation and distribution to pouches.

COST ACCOUNTING

Defects in. What is Wrong With Cost Accounting? G. Charter Harrison. Management Eng., vol 1, no 1, July 1921, pp. 29-32. Defects of present methods.

Manufacturing Cost. The Elements in Manufacturing Cost. Frederic H. Leland. Management Eng., vol 1, no 2, Aug 1921, pp 87-88. Discusses three groups of manufacturing costs, namely, general plant expenses, foundry cost and expenses and manufacturing departments costs and expenses.

COST SYSTEMS

Modern. Disclosing Waste Through Better Cost Methods, Ernest J. Wessen. Chem. & Metallurgical Eng., vol 25, no 9, Aug 31, 1921, pp 389-393. Claims that many industrial failures are traceable to blind dependence on cost determined by rule-of-thumb methods. Modern costs systems disclose waste in unprofitable products, idle labor and machinery and erroneous methods.

CRANES

Floating. A 60-Ton Self-Propelling Floating Crane, Engineer, vol. 132, no. 3420, July 15, 1921 pp. 72-73, 2 figs. Also in Shipbldg & Shipg Rec., vol. 18, no 6, Aug. 11, 1921, p. 181. Slewing and derricking type of crane built by Werf Gusto (Firma A. F. Smulders), Schiedam, Holland, for Manchester Ship Canal Co.

CRANKCASES

Machining Operations. Machining the Peerless Upper Crankcase, Fred H. Colvin. Am. Mach., vol. 55, no 10, Sept. 8, 1921, pp. 376-380, 20 figs. Method of handling upper or main crankcase in shop of Peerless Motor Car Co. Sequence of operations. Inspection gages.

CRANKPINS

Machine for Turning. A New Crankpin Turning Machine. Eng. Production, vol. 3, no. 46, Aug. 18, 1921, pp. 155-156, 3 figs. Mechanism of machine designed for economical production, constructed by George Richards & Co., Ltd., Manchester, England.

CYLINDERS

Boring. Cylinder Boring. Eng. Production, vol. 3, no. 45, August 11, 1921, pp. 127-132, 17 figs. Discusses principles and practice.

Calculation of Wall Strength. Graphic Determination of the Strength of Walls in Hollow Bodies (Graphische Bestimmung von Wandstäaken bei Hohlkörpern), Arthur Balog. Zeit für Dampfkessel u Maschinenbetrieb, vol. 44, no. 4, Jan. 28, 1921, pp. 28-29. Describes method applicable to hollow cylinders with internal pressure.

Thick. The Thickness of Hydraulic Cylinders, H. S. Cattermole. Mech. Wld., vol. 52, no. 1805, August 5, 1921, pp. 102-103, 1 fig. Discusses well-known fact that thick cylinders are not as strong relatively as thin ones.

D

DAMS

Types. The Dam and Its Appurtenances, N. L. Devenport. Power vol. 54, no. 2, Aug. 9, 1921, pp. 213-216, 6 figs. Pointers of value to operator on different types of dam.

DIESEL ENGINES

Appraising. Appraising the Diesel Engine Plant, Allen F. Brewer. Indus. Management, vol. 62, no. 3, Sept. 1, 1921, pp. 172-176, 4 figs. Important features that must be considered and analyzed. Calculation and estimation of cost data and depreciation.

Modern Marine Oil Engines-II-VI. Engineer, vol. 132, nos. 3418, 3420, 3422, 3423, and 3424, July 1, 15 and 29, and Aug. 5 and 12, 1921, pp. 2-3, 4 figs., 55-57, 11 figs., 109-111, 6 figs., 136-137, 3 figs. and 174-176, 6 figs., July 1: New type 3200-i. hp. Harland & Wolff Diesel marine engine. July 15: Vickers 1250-b. hp. type. July 29: North British 2330-i. hp. type Aug. 5: 1400-i. hp. Werkspoor type. Aug. 12. 1250-b. hp. Sulzer 2-cycle engine.

Notes on the Management of Marine Diesels, Homer McCrirrick. Marine Eng. of Can., vol 11, no. 7, July 1921, pp. 10-14, 6 figs. Compares four-cycle and two-cycle diesels and discusses various features in detail.

Problems in the Manufacture of Marine Diesel Engines. Machinery (Lond), vol. 18, no. 461, July 28, 1921, pp. 513-514, 4 figs. Choice of material and methods of machining Diessel-engine parts.

DROP FORGING

Dies. Design and Making of Drop forging Dies. Machy. (N.Y.), vol. 27, no. 12, August 1921, pp. 1141-1144, and vol. 28, no. 1, Sept. 1921, pp. 33-36, 12 figs. Methods employed in modern drop-forging plants.

E

EDUCATION ENGINEERING

Improvements in Training. The College Trained Engineer, C. Edward Magnusson. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 9, Sept. 1921, pp. 730-736. Suggestions for improvement.

ELECTRIC CONDUCTORS

Skin Effect in Large Stranded. Skin Effect in Large Stranded Conductors at Low Frequencies, W. I. Middleton and E. W. Davis. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 9, Sept. 1921, pp. 757-763, 5 figs. Discusses three common formulas for skin effect, via., Thomson's, Gray's and Rushmore's. Points out that the latger the size of strand ysed for any conductor, the less the skin effect and the less the amount of useless copper. For practical purposes, size of strand should not be so large as to interfere with flexibility of cable.

ELECTRIC CURRENTS, ALTERNATING

Vector Analysis. Alternating Current and Vector Analysis (Courants alternatifs et calcul vectoriel), (Cont.), R. Le Cocq. Revue Générale de L'Électricité. vol. 10, no. 4, July 23, 1921, pp. 123-128. (Concluded).

ELECTRIC DISTRIBUTION

London. Production and Distribution of Electricity in London (La Question de la Producton et de la Distribution de l'Électricité à Londres). H. Marchand. L'Industrie Electrique, vol. 30, no. 699, Audust 10, 1921. pp. 291-293, 1 fig. Steps proposed by Committee of Experts, central authority, to bring production up to requirement.

Machine Tools. Electric Motor Drive for Machine Tools, Gordon Fox. Ry. Elec. Engr., vol. 12, no. 8, August 1921, pp. 317-321, 5 figs. Discusses relative advantages of different types of motors.

ELECTRIC FURNACES

Ajax-Wyatt. The Ajax-Wyatt Electric Furnace, John B. C. Kershaw. Engineer, vol. 132, no. 3423, Aug. 5, 1921, pp. 139-140, 4 figs. Details of improved type. For special work of melting yellow brass, on scale which permits continuous operation of furnace, it is said to be most efficient type.

Design. Electric Furnace Operating Experiences, Larry J. Barton. Iron Age, vol. 108, no. 10, Sept. 8, 1921, pp. 581-584, 6 figs. Experiments with three forms of furnace bottom. Methods of building bottoms. Experiments with roof and sidewalls. Metallurgical features.

Non-Ferrous. Steel in a Non-Ferrous Electric Furnace. Iron Age, vol. 108, no. 8, Aug. 25, 1921, p. 472, 1 fig. Successful production of crucible quality steel in small Baily resistance unit.

ELECTRIC GENERATORS, D. C.

Voltage Characteristics. Voltage Characteristics of Direct-Current Generators and Their Bearing on Parallel Operation, Eustis H. Thompson. Power, vol. 54, no. 8, Aug. 23, 1921, pp. 287-290, 6 figs. Discusses factors and adjustments that may sometimes be made to correct trouble in machines with and without interpoles.

ELECTRIC LOCOMOTIVES

Oerlikon. New Single-Phase Locomotive of the Swiss Railways (Les Nouvelles Locomotives Monophasées des Chemins de Fer Féderaux), Lucien Pahin. L'Industrie Electrique, vol. 30, no. 699, August 10, 1921, pp. 285-290, 7 figs. Describes the 2-6-2 Oerlikon type of Gothard line, its mechanical and electrical equipment.

ELECTRIC MACHINERY

Balancing. Balance of High-Speed Electric Dynamos and motors, H. D. Wheeler. Electrician, vol. 87, no. 2254, July 29, 1921, pp. 136-138, 9 figs. Indicates briefly some of the main causes of vibration in turbo-generators and similar machines and how to overcome it.

ELECTRIC MOTORS

Control. Motor-Control Equipment-Protective Features, H. D. James. Power, vol. 54, no. 5, Aug. 2, 1921, pp. 169-171, 4 figs. Notes on controllers with air-and oil-break contactors; overload protection; fuses and circuit breakers; protection against low voltage and reverse-phase operation.

Types of Contactors and Relays for Motor Control, G. J. Kirkgasser and E. W. Seeger. Elec. Rev. (Chicago), vol. 79, no. 8, August 20, 1921, pp. 273-278, 18 figs. Describes lplunger and clappor type electromatnets; d. c. shunt type, a. c. and series and lockout contactors; various relays.

Overload Protection. Overload Protection of Motors Edgar. P. Slack. Power, vol. 54, no. 4, July 26, 1921, pp. 132-133. Use of fuses, circuit breakers and motor starters.

ELECTRIC MOTORS, A. C.

Induction. Induction Motor Core Losses, P. L. Alger and R. Eksergian. Publications of Mass. Inst. Techn., vol. 56, no. 31, February 1921, 15 pp., 17 figs. Core losses are divided into six elements, one of which only is calculated ordinarily by designing engineers, with resulting large discrepancies.

ELECTRIC MOTORS, D. C.

Voltage Fluctuations. Effects of Voltage Fluctuations on Direct-Current Motors, H. M. Phillips. Power, vol. 54, no. 7, Aug. 16, 1921, pp. 255-257. 4 figs. Limitations in voltage variation. Comparison of motor characteristics when lowering voltage on both field and armature. What happens on motor when voltage fluctuates 10 per cent from normal. Both interpole and non-interpole machines are considered.

ELECTRIC PLANTS

Parallel Operation. Unstable Operation of Generating Stations in Parallel, D. D. Higgins. Elec. Wld., vol. 78, no. 9, August 27, 1921, pp. 414-416, 3 figs. Discusses results of tests made, puts emphasis on proper relation of resistance and reactance.

ELECTRIC RAILWAYS

Catenary Trolley Wire Suspension. Electric Overhead Equipment (Note sur les lignes caténaires pour prise de courant aérienne destinées à l'électrification des voies d'intérêt général), Paul Leboucher. Revue Générale de L'Electricité, vol. 10, no. 7, August 13-20, 1921, pp. 225-238, 32 figs. Describes various types of overhead lines for traction at high tensions, especially that of Phila.-Paoli line. (Concluded).

Three-Wire Distribution. Three-Wire Railway Distribution in Wilmington, A. P Way. Elec. Ry. Jl., vol. 58, no. 9, August 27, 1921, pp 307-311, 5 figs. Improves regulation and prevents electrolysis. Trial proves system best adapted to radial city districts.

Trolley Systems. Electric Overhead Line Systems (Note sur les lignes caténaires pour prise de courant aérienne destinées à l'électrification des voies d'intérêt général). Paul Leboucher. Revue Générale de Électricité, vol. 10, no. 6, August 6, 1921, pp. 195-201, 16 figs. Discusses pantograph trolley and feeding of current. (To be continued.)

ELECTRIC RAILWAYS, TRACK

Maintenance. Tramway Track Maintenance, Robert B. Holt. Elec. Ry. & Tramway Jl. vol. 45, no. 1091, August 12, 1921, pp. 120-126 and Discussion pp. 126-128, 14 figs. Discusses rail wear, rail corrugation, welding and rail bardening process, etc. Paper read before Tramways & Light Railways Assn.

ELECTRIC TRANSMISSION LINES

Economical Construction. Economical Methods of Line Construction Work, M. T. Crawford. Stone & Webster Jl., vol. 29, no. 2, August 1921, pp. 117-124, 4 figs. Describes methods adopted by Puget Sound Power & Light Co. counteracting increased labor and material costs.

Iron and Steel Wire. Transmission Characteristics of Iron and Steel Wire, Edwin Kurtz. Elec. Rev., (Chicago), vol. 79, no. 6, August 6, 1921, pp. 200-202, 8 figs. Considers pure atmospheres best for iron and steel wires.

Long-Distance, Voltage Regulation for. Voltage Regulation and Insulation for Large Power, Long Distance Transmission Systems, Frank G. Baum. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 8, Aug. 1921, pp. 643-665, 41 figs. A standard frequency of 60 cycles is advocated for national system, and 220,000 volts proposed as standard for extra large-power, long-distance transmission. Advantages of proposed system are pointed out. Discusses problems of line insulation, and especial attention is called to necessity for low air and leakage resistance stresses. New diagram is given from which characteristics of long strings of insulator strings may be calculated.

Steel Towers. Tests on Full-Size High-Voltage Transmission Towers, Eugen F. Kriegsman. Eng. News-Rec., vol. 87, no. 9, Sept. 1, 1921, pp. 350-351, 4 fig. Vertical, longitudinal and transverse loads totaling 38.8 tons applied to 98-sft. towers for new California line.

ELECTRIC WELDING

Methods. Electric Welding Apparatus (Les Machines à Souder), Ch. Andry-Bourgeois. L'Electricien, vol. 52, no. 1282, August 15, 1921, pp. 361-367, 8 figs. Discusses various methods of electric welding and uses made of them. (To be continued.)

ELECTRIC WELDING, ARC

Electric-Railway Work. Electric Arc Welding, Henry M. Sayers. Elec. Ry. & Tramway Jl., vol. 45, no. 1091, August 12, 1921, pp. 129-132 and Discussion pp. 132-133, 7 figs. Deals with failures, welding of lattice masts, covered and bare electrodes, etc. Paper read before Tramways & Light Rys. Assn.

Fillet and Butt Welding. Fillet and Butt Welding by the Electric Arc,. Can. Machy., vol. 26, no. 6, August 11, 1921, pp. 33-34 and 53, 2 figs. Discusses welds by spreading, butt welding, double "V" weld.

Machines. A New Electric Arc Welding Machine. Engineer, vol. 132, no. 3418, July 1, 1921, pp. 18-19, 5 figs. Details and working of new machine known as cyc arc, because of regular cycle of operations on which its success depends and which it accurately performs.

ELECTRIC WELDING, RESISTANCE

Spot-Welding Machines. Spot-Welding Machines (Machine à Souder Par Points), P. Saurel. Arts et Métiers vol. 74, no. 9, June 1921, pp. 173-177, 13 figs. Describes principle, apparatus and operation.

Spot Welding Machine for Making Ships' Ventilators. Engineer, vol. 132, no. 3424, Aug. 12, 1921, p. 176, 1 fig. New type of electric machine for manufacture of large ventilating cowls for steamships, and other bulky hollow sheet metal articles of similar nature.

ELEVATORS

Safety Devices. Electric Elevator Machinery-Car Safeties. M. A. Myers. Power, vol. 54, no. 5, Aug. 2, 1921, pp. 176-177, 6 figs. Describes heavy-duty double-eccentric, compression-type and flexible guide-clamp type safety.

EMBOSSING

Dies. Making Embossing Dies for Emblematic Work, Chas E. Hall. Can Mach. vol 26, no 7, August 18, 1921, pp. 36-38, 5 figs. Discusses hub method, "cut in" system, and their combination.

EMPLOYEES, TRAINING OF

Economic Advantages. Training as a Factor in Reducing Labor Cost, J. F. Johnson. Management Eng., vol 1, no 1, July 1921, pp. 5-9, 5 figs How instructing the worker enhances his skill, increases production and lowers manufacturing costs.

Training as a Factor in Reducing Waste, J. F. Johnson. Management Eng., vol 1, no. 2, Aug 1921, pp 93-97, 6 figs How teaching of correct working habits will develop skill, reduce labor turnover and save material.

EMPLOYMENT MANAGEMENT

Personnel, Selection and Placement of The Personnel Problem: To Eliminate the Waste of Human Effort, L. B Hopkins. Chem & Metallurgical Eng., vol. 25, no. 9, Aug. 31, 1921, pp 385-388. States that many wastes of time and production can be attributed to improper selection and placement of personnel and to management's failure to recognize value of training, transfer and promotion of deserving employees.

Present Need of. Is Personnel Management Essential Now?, Earl B. Morgan. Management Eng., vol. 1, no. 2, Aug. 1921, pp. 89-92. Points out that pressing labor problems must be solved in periods of force reductions as well as in times of shortage of workers.

ENGINEERING LITERATURE

Classification and Indexing Classifying and Indexing the Clipping File, Harrison W Craver, Management Eng., vol no. 1, July 1921, pp 48-50 Applying use of decimal classification system to engineering literature. Adoption by Engineering Societies library. Plan of Management Engineering.

ENGINEERS

Problems Confronting. The Pioneer Spirit in Engineering, E. S. Carman. Management Eng., vol. 1, no. 1, July 1921, pp. 1-3. As developed in Federated Am. Eng. Societies. Notes on engineers' problem of future; two major influences in engineering elimination of waste in industry.

F

FACTORIES

Design. The Design and Construction of Engineering Workshops-XXI. Ernest G. Beck. Mech. Wld., vol. 52, no. 1806, August 12, 1921, pp. 122-123, 6 figs. Continues discussion of construction of roofs. (To be continued.)

Location. Location as a Factor in Eliminating Industrial Waste, Victor V. Kelsey. Chem. & Metallurgical Eng., vol 25, no. 9, Aug. 31, 1921, pp. 401-402. Main factors to be considered are: Influnece which proposed industry will have on community, raw materials, transportation, labor supply and power.

The Scientific Location of Manufacturing Plants, J. George Frederick. Indus. Management, vol. 62, no. 3, Sept. 1, 1921, pp. 153-155, 1 fig Deals with considerations that govern proper location of manufacturing plant and conditions arising due to shift of population on manufacturing centers.

Layout Developing an industrial Plant Layout, A. T. Doud. Indus. Management, vol. 62, no. 3, Sept. 1, 1921, pp. 149-152, 4 figs. Points out that in complete design of new plant, it is necessary to work out together the general production system, department layout and general features of building construction in order to insure well-balanced plant.

FACTORY MANAGEMENT

See industrial management.

FATIGUE

Testing. Improvements in Methods of Fatigue Testing, H. J. Gough. Engineer, vol. 132, no. 3424, Aug. 12, 1921, pp. 159-162, 13 figs. Report submitted to materials and chemistry committee of Aeronautical Research Committee. Experiments alternating torsion; forms of test pieces; strain on measurements; method of test using strain and calorimetric methods simultaneously; etc.

FIRE HAZARDS

Review of. Some Considerations on Fire Waste, Nicholas Richardson. Chem. & Metallurgical Eng , vol. 25, no. 9, Aug. 31, 1921, pp 397-400. Industry in general, and chemical industry in particular, is said to be in need of fuller appreciation of fire hazards and appalling waste due to destruction by fire. Review of possible fire hazards.

FIRE PROTECTION

Slow-Burning Buildings. Specifications for "Slow Burning" Office Buildings, Ira H. Woolson. Eng. & Contracting, vol. 56, no. 8, Aug. 24, 1921, pp. 178-179. Report submitted by committee on building construction of Nat. Fire Protection Assn. contains proposed specifications for rendering so-called non fire-proof class of commercial buildings reasonably slow-burning.

FLOW OF WATER

Chezy Formula Antoine Chezy History of an Hydraulic Formula (Antoine Chezy. Histoire d'une Formule d'Hydraulique). G Mouret Annales des Ponts et Chaussées, vol 59, no 2, 11th Series, March-April 1921, pp 165-208 His formula $U = C\sqrt{(RI)}$ for flow of water Bibliography

Photographic Measurement Use of Photography in Hydraulic Measurements in India, S. C. Majumdar Eng News-Rec. vol 87, no Sept 8, 1921, pp 414-415, 2 figs Photographic tests made on large jets are said to check remarkably close with actual gagings by current meter

Venturi Tubes. Nomograms for Calculating Flow in Venturi Tubes, J W Ledoux. Eng & Contracting, vol 56, no. 6, Aug 10, 1921, pp 138-139, 3 figs Three nomograms are presented and their uses explained

FOUNDRIES

Brass and Aluminum. Features of a Non-ferrous Metal Foundry, F L. Prentiss. Iron Age, vol 108, no 9, Sept 1, 1921, pp. 511-513, 3 figs. Outstanding features of new jobbing brass and aluminum foundry of National Bronz & Aluminum Co., Cleveland, Ohio.

Continuous. Continuous Foundry for Pipe Fittings, Henry M. Lane Iron Age, vol. 108, no 9, Sept. 1, 1921, pp. 519-524, 10 figs. Designed for minimum handling of sand, castings, cores, hot metal and flasks. Layout and details.

Electrical Equipment. Electrical Apparatus in the Foundry, F. D Egan. Foundry vol 49, no. 16, August 15, 1921, pp. 646-651, 16 figs. Discusses cupola and air furnaces, transformers and motor equipment, also gives data on operation of foundries.

Mechanical Control. Mechanical Control in Foundry Problems, J. H. Hopp. Iron Age, vol 108, no. 8, Aug 25, 1921, pp. 456-458, 5 figs. Discusses several cases showing how application of simple mechanics produced results which chemistry alone did not. (Abstract.) Address delivered before Southern Metal Trade Assn.

FRICTION

Rolling. Measuring Accelerations and Coefficients of Rolling Friction At the Metropolitan Railway of Paris (Mesures d'accélérations et de coefficients de roulement au chemin de fer métropolitain de Paris), R. Van Cauwenberghe. Société Belge des Électriciens, vol. 35, May-June 1921, pp. 101-118, 9 figs. Describes level and electric accelerometers and tests made with former.

FUEL CONSERVATION

Power-Plants. Elimination of Waste in Industrial Power Plants, David Moffat Myers. Chem. & Metallurgical Eng , vol. 25, no. 9, Aug. 31, 1921, pp. 413-416. Shall an industry own its power plant or by his power? Determining factor is relation of heating and process steam to power demand. The what and why of fuel economy.

FUELS

Bituminous Coal. Utilization Refinement of Fuels, F. P Coffin. Gas Age-Rec., vol. 48, no 5, August 20, 1921, pp. 176-178. Discusses processes for conversion of bituminous coal into primary fuel and power.

Utilization. Commission for Utilization of fuel (Commission D'Utilisation du Combustible). Revue de L'Industrie Minérale, no. 14, July 15, 1921, pp. 506. (Continuation of serial.)

See also lignite; peat.

FURNACES, ANNEALING

Gas-Fired. Gas-Fired Annealing Furnace. Iron & Coal Trades Rev., vol. 103, no. 2786, July 22, 1921, pp. 107, 3 figs. Describes tests made with plant consisting of two self-contained twin-pot rotary flame annealing furnaces.

G

GAGES

Inspection. The Delco Inspection System, Erik Oberg. Machy. (N. Y.), vol. 27, no. 12, Aug 1921, pp. 1127-1130., and vol. 28, no. 1, Sept. 1921, pp. 43-47., 23 figs. Typical Examples of gaging fixtures used by Dayton Engineering Laboratories Co. in manufacture and inspection of company's product.

GAS PRODUCERS

Operation. Gas-Producer Pratice, N. R. Rees. Mech. Wld., vol. 70, no. 1804, July 29, 1921, pp. 89-90. Discusses essential features even distribution of coal, uniform production of good quality gas, regulation of depth of fuel bed, removal of ashes and clinker, and low cost of operating.

GEAR CUTTING

Stevenson Multiple Shaper The Stevenson Multiple Shaper. Machinery (Lond.), vol. 18, no. 463, August 11, 1921, pp. 578-581, 8 figs. A new type of gear-cutting machine.

GEARS

Fabroil. Fabroil and Textoil-Textile Fibre Products that Give Good Service In Gears, G. L. Wilder. Raw Material, vol. 4, no. 8, August 1921, pp. 279-280, 1 fig. Dicsusses fabroil gears and textoil gears.

Grinding. Grinding Gear Wheel Teeth. Engineer, vol. 132, no. 2342, July 29, 1921, pp. 112-113. 2 figs. Describes specialist work of grinding of tooth profiles to a stated standard of accuracy performed by Gear Grinding Co., Ltd., Birmingham.

Involute. Inspection of Involute Spur and Helical Gear Hobs-I, Carl G. Olson. Machy. (N. Y.), vol. 28, no. 1, Sept. 1921, pp. 11-13, 12 figs. Testing accuracy of hob and tooth parts; hobbing tests.

The Evolution of the Involute Gear Tooth-VII and VIII, A. Fisher. Machinery (Lond.), vol. 18, nos. 461 and 462, July 28 and Aug. 4, 1921, pp. 507-510, 4 figs. and 547-551, 14 figs. Discusses conditions of contact, lengths of contact paths and numbers of teeth.

Maag. Principles of Maag Gearing. Machy. (N. Y.), vol. 28, no. 1, Sept. 1921, pp. 48-52, 9 figs. Analysis of Maag system of gearing, advantages claimed for this type of gears, and machines for their production.

Rolling-Mill Driving. Cutting Rolling Mill Driving Gears Fred R. Daniels. Machy. (N. Y.), vol. 28, no. 1, Sept. 1921, pp. 1-4, 5 figs. Producing large herringbone gears by end-milling process at Woodard Machine Co 's plant in Wooster, Ohio.

GIRDERS

Reinforced-Concrete. Construction Joints in Concrete Girders of 62½ Ft. Span. Eng. News-Rec., vol. 87, no. 9, Sept. 1921, pp. 348-350, 4 figs. Unique design is said to be safeguard reinforced-concrete garage under Williamesburg bridge against cracking in event of uneven pier settlement.

GLASS MANUFACTURE

Sheet, Drawing. The Drawing of Sheet Glass. Glass Ind., vol. 2, no. 8, August 1921, pp. 190-193, 3 figs. Describes invention of Emile Gobbe developed by Emile Fourcault, and results obtained leaving no doubt as to ultimate of process. (Abstract, Le Verre.)

GRAIN ELEVATORS

Floating Pneumatic. The Floating Pneumatic Grain Elevator at Avonmouth Dock, George F. Zimmer. Eng. & Indus. Management, vol. 6, no. 8, Aug. 25, 1921, pp. 221-225, 4 figs. Details of pneumatic plant known as the Alpha, which is mounted on pontoon of reinforced concrete divided by concrete bulkheads into separate compartments for accommodation of boiler, engine, elevators, and crew.

GRAIN HANDLING

Pneumatic Plant. Pneumatic Grain-Discharging and Sack-Handling Plant at Bordeaux. Engineering vol. 112, no. 2904, Aug. 26, 1921, pp. 312-314, 19 figs. partly on p. 316 and supp. plate. Two traveling pneumatic grain-discharging installations, delivering on to elvated belt conveyors running length of wharf; these conveyors deliver in turn to others running at right angles to them, back to silos of 7500 tons capacity, whence grain may be stacked off and stored in warehouses. (To be continued.)

GRINDING

Automobile Parts. Grinding in the Automotive Industry-II, P. M. Heldt. Automotive Ind., vol. 45, no. 7, August 18, 1921, pp. 315-317, 3 figs. Development of specialized forms of grinding. (To be continued.)

Fixtures. Grinding Practice—Variety of Fixtures Used, F. Scriber. Can. Machy., vol. 26, no 6, August 11, 1921, pp. 28-31, 14 figs. Discusses principles and shows how grinding wheel comes into contact with work.

Some Novel Grinding Fixtures, Andrew Macnab. Am. Mach., vol. 55, no. 8, Aug 25, 1921, pp. 309-312, 9 figs. Grinding blocks with ends parallel. A fixture that failed and how trouble was remedied.

GRINDING MACHINES

Manufacture. Building Grinding Machines. Eng. Production, vol. 3, no. 45, August 11, 1921, pp. 133-139., 19 figs. Description of products of Churchill Machine Tool Co., Ltd., Manchester, Eng.

H

HANDLING MATERIALS

Automobile Plant. Handling Materials in an Automobile Plant, Fred H. Colvin. Am. Mach., vol. 55, no. 8, Aug. 25, 1921, pp. 292-296, 12 figs. Utilizing elevators and floor openings for carrying material from one floor to next. Continuous assembly and modern devices for facilitating work.

Methods. Moving Parts from Operation to Operation, J. M. Macrae. Management Eng., vol. 1, no. 3, Sept. 1921, pp. 167-169, 4 figs. Discusses four methods: Moving by trucks, rolling down chutes, sliding on gravity conveyors, handling by power conveyors.

HEALTH

Chemical Industry. Occupational Diseases in Chemical Industries, Frederic Dannerth. Indus. Management, vol. 62, no. 3, Sept. 1, 1921, pp. 145-147, 4 figs. How workers in chemical plants are safeguarded.

Industrial. Human Waste in Industry, Harry E. Mock. Chem. & Metallurgical Eng., vol. 25, no. 9, Aug. 31, 1921, pp. 369-374, 2 figs. Strong emphasis is placed on role of physician in industrial plants, with outline of preventive and curative medical services which caan be rendered to working forces in industry.

HEATING

Gas and Electric. Gas and Electric Heating (Chauffage au gaz et chauffage à l'électricité), A. Grebel. Chaleur et Industrie, vol. 2, no. 15, July 1921, pp. 426-432. Comparative analysis concerning domestic heating.

HEATING, ELECTRIC

Granular Metal. Using Granular Metal in Electric Heating (Sur l'emploi des métaux granularies pour le chauffage électrique), Oct. Dony-Hénault. Académie Royale de Belgique-Memoires, vol. 6, March 1921, 57 pp. 15 figs. Discusses granular resistances; comparison of carbon resistances with granular metal ones; electric properties of granular metallic masses; granular conductivity; melting point of granular metal etc. in connection with electric furnaces.

HOUSING

Dense Tenement Populations, Eliminating. Population Density as a Basis for Housing Regulations, Frank B. Cartwright. Eng. News-Rec., vol. 87, no. 8, Aug. 25, 1921, pp. 318-322, 3 figs. Intensive Rochester study indicates that improved transit, industrial decentralization, zoning and other current changes render dense tenement populations unnecessary in most cities.

Traffic and. Traffic and Housing in Large Cities, Arthur Ertel. Elec Ry. Jl., vol. 58, no. 6, August 6, 1921, pp. 199-201, 5 figs. Finds that there exists a definite relation between track and building development within different areas equidistant from a city centre. (Abstract from Verkehrstechnik.)

HYDRAULIC PRESSES

Single-Acting. Pressing Stator Plates into Motor Casings, and Rotor Plates on Squirrel Cage Rotors on a Single-Acting Hydraulic Press. J. Blakey and J. Shankley. Eng. & Indus. Management, vol. 6, no. 4, July 28, 1921, pp. 86-87, 13 figs. Equipment designed for use in connection with single-acting hydraulic press

HYDRAULIC TURBINES

Draft Tubes. Hydro-Electric Practice—Draft Tubes, C. Voetsch. Power, vol. 54, no. 5, Aug. 2, 1921, pp. 164-167, 10 figs. Discussion and comparison of various types of draft tubes.

High-Head Reaction. Important Features in the Design of High-Head Reaction Turbines, F. H. Rogers. Power, vol. 54, no. 7 Aug. 16, 1921, pp. 244-248, 9 figs. A 30.000-hp. unit for Big Creek, no. 8 development of Southern California Edison Co. Leakage at runner seals and around guide vanes. Draft tube, casing and relief-valve design. Lubricating of internal parts. Governor control.

Wear. Wear of Hydraulic Turbines (L'Usure des Turbines Hydrauliques)-IV, Henri Dufour. La Houille Blanche, vol. 20, no. 53-54, May-June 1921, pp. 97-103, 13 figs. Description of sand removers used at Ackersand Works.

HYDROELECTRIC PLANTS

Waterwheel Design and Setting. Advances in the Art of Warterwheel Designs and settings, W. M. White. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 8, Aug. 1921, pp. 668-682, 23 figs. Notes on speed regulation; runners and runner materials; draft tubes; shaft and bearings; guide vanes; governors; turbine casing; vertical vs. horizontal units, control valves; and power house setting.

I

INDUSTRIAL MANAGEMENT

Administrative Planning. Planning Applied to Administration. Eng. & Indus. Management, vol. 6, no. 7, Aug. 18, 1921, pp. 174-177. Indicates to what extent field of industrial administration has been entered by scientific management. Notes on planning of sales, relationship between stock and finished products, and finances.

Budgets and Production. The Expense and Finance Budgets, Park Mathewson. Indus. Management, vol. 62, no. 2, Aug. 1, 1921, pp. 109-113, 3 figs. How they concern production.

Charts. Managing an Industry by Graphic Charts, Arthur T Burnet. Management Eng., vol. 1, no. 2, Aug. 1921, pp. 83-87, 2 figs. Typical charts and their use. How current facts are quickly and economically supplied to excutive.

Standardizing the "Z" Chart, Arthur R. Burnet. Management Eng., vol. 1, no. 3, Sept. 1921, pp. 153-158, 4 figs. Discusses standardizing type of management engineering chart known as the "Z" chart to permit of its production in quantity.

The Ratio Chart and Its Application-II and III, Percy A. Bivins. Indus. Management, vol. 62. nos. 2 and 3, Aug. 1 and Sept. 1, 1921, pp. 99-104 and 166-171, 19 figs. Based on memo notes of an office manual for guidance of draftsmen unfamiliar with ratio plotting. Advantages and disadvantages of ratio charts compared with charts on arithmetic basis.

See also gantt charts.

Efficiency. The Final Measure of Industrial Efficiency, A. L. DeLeeuw. Management Eng., vol. 1, no. 3, Sept. 1921, pp 141-146, 1 fig Notes on how to obtain maximum efficiency. Consideration of equipment and plant efficiency. Influence of capital charges. An application of index numbers.

Engineering Students, Training in. Existing Courses in Management Engineering, Collins P Bliss. Management Eng., vol. 1, no. 1, July 1921, pp 43-48, 1 fig. Gives make-up of eight courses and time allotted to each general group of subjects and to each study. Summary and chart showing number of hours devoted to individual subjects.

Gantt Charts. The Gantt Chart, Wallace Clark. Management Eng., vol. 1, nos 2 and 3, Aug and Sept., 1921, pp 77-82, 9 figs., and 161-166, 6 figs. Advantages, principle, technique and application to man records and layouts.

Inspection. Inspection. Mech. Wld., vol. 52, no. 1806, August 12, 1921, pp. 118-119, 5 figs. Discusses necessity for inspection and tact required by inspector.

Marketing. The Elimination of Waste in Marketing, William R. Basset. Chem. & Metallurgical Eng., vol. 25, no. 9, Aug. 31, 1921, pp 420-122. States that marketing from point of view of manufacturer can be made more profitable by application of better methods of distribution and by establishment of improved selling policies.

Material Specifications. Material Specifications, I. A. Allent. Eng. & Ind. Management, vol 6, no. 5, August 4, 1921, pp 114-115. Emphasizes necessity for complete specifications of materials in case of small users.

Overtime, Influence of. The Influence of Overtime on Costs, B. C. Sloat. Management Eng., vol. 1, no. 1, July 1921, pp 9-10. Wage costs and shop maintenance as influenced by overtime; effect on shop morale and on workmanship.

Planning. Precalculation in the Factory (Aufgabeneiner Betriebsvorkalkulation), Paul Bischoff. Werkstattstechnik, vol. 15, no. 15, Aug. 1, 1921, pp 448-450, 5 figs. Points out advantages of predetermination of time required for finishing a workpiece.

Production Control. Production Control. P. J. Darlington. Indus. Management, vol. 62, no. 2, Aug. 1, 1921, pp 95-98, 2 figs. Its strong and weak points. Author sets forth purposes and requirements and emphasizes permanent management's vital relationship to system.

Production, Economics of. The Economics of Production—III, D. A. McCabe. Am. Mach., vol. 55, no. 10, Sept. 8, 1921, pp. 381-382. Costs and price and production.

Production Increase. Accumulative Skill As a Factor in Production, Hugo Diemer. Management Eng., vol. 1, no. 2, Aug. 1921, pp. 111-112. Proof that group experience and pride in work increase output.

Scientific Management—XXIX, Henry Atkinson. Eng. & Indus. Management, vol. 6, no. 4, July 28, 1921, pp. 97-98. Incentives to economical production.

Six Ways of Increasing Production, G. D. Halsey. Management Eng., vol. 1, no. 2, Aug. 1921, pp 97-98. (1) Introduction of labor-saving machinery; (2) specialization; (3) aggregation (combination with any other department); (4) standardization of parts; (5) elimination of wastes of materials; and (6) increasing individual efficiency.

Program For. What is Management in Industry?, C. E. Knoeppel. Management Eng., vol. 1, no. 1, July 1921, pp. 23-28, 1 fig. Placing blame and fixing responsibility. A program for management.

Routing. Cutting Out Waste in the Shop. Elec. Ry. Jl., vol. 58, no. 6, August 6, 1921, pp 193-198, 24 figs. Discusses minimizing of lifting operations, effective routing of machine jobs and permanent repair of defective parts.

The Group System of Process Planning, W. J. Hiscox. Machinery, (Lond.), vol. 18, no. 464, August 18, 1921, pp. 600-601. Discusses routing of jobs through the shop.

Small Factories. Management Problems of the Small Factory, Ernest Cordeal. Indus. Management, vol. 62, nos. 2 and 3, Aug. 1 and Sept. 1, 1921, pp. 114-119 and 182-187, 4 figs. Aug.: Costs and their use. Sept.: Supervision and inspection.

Storekeeping. The Essential of Storekeeping, Wallace Clark and C. E. Davies. Management Eng., vol. 1 no. 1, July 1921, pp. 11-16, 9 figs. Notes on storekeeper's responsibilities; marking the order points; keeping records of stock; safeguarding stores; disposing of unneeded material; and selection and training of personnel.

Woodworking Shops. Production Control in Wood-Working Shops, F. B. Sampson. Wood-Worker, vol. 40, no. 6, August 1921, pp 30-32, 8 figs. Outline of fundamentals of production control. Gives time allowance and operations layout charts.

See also Fatigue; Time Study.

INDUSTRIAL ORGANIZATION

Large Contract Plants. Organization of Large Contract Plants, George H. Shepard. Machy. (N.Y.), vol. 27, no. 12, Aug. 1921, pp. 1100-1103, 3 figs. Deals with organization of plants making variety of products, and establishment of planning dispatching, and recording systems.

Small Shops. Organization and Management of the Small Shop—IV, E. W. Leach. Am. Mach., vol. 55, no. 9, Sept. 1, 1921, pp. 338-341. Financing company; co-operating with investor; advantages and disavantages of partnerships and corporations.

INDUSTRIAL RELATIONS

Americanization. Industrial Americanization, Luther D. Burlingame. Machy (N. Y.), vol 28, no 1, Sept. 1921, pp 30-32. Policy of Brown & Sharpe Mfg Co in assisting alien employees to become American citizens.

Human Elements in. Human Elements in Engineering, J. J. Flather. Bul. Minn Federation Architectural & Eng Societies, vol 6, no 7, July 1921, pp 21-32. Discusses hours of work, pleasant surroundings, etc., and their influence on production. Lays stress on the point that philanthropy has no part in industrial management.

INDUSTRY

Arbitration Courts. Wastes in Litigation, Wellington Gustin. Chem. & Metallurgical Eng., vol. 25, no. 9, Aug. 31, 1921, pp 423-427. Losses arising from litigation said to be potential factor in success or failure of any industry or business. Lack of knowledge of technical terms and standards on part of courts a strong argument for establishment of arbitration courts within industry.

INSULATORS, ELECTRIC

Bushing for High Frequency. Entering Bushings Designed for High Frequency, George Lewis. Elec. Rev., (Chicago) vol. 79, no. 6, August 6, 1921, pp. 197-199, 7 figs. Discusses strains imposed on insulators, shape of shield and impact test.

INSULATION, ELECTRIC

Porcelain. The Manufacture and Testing of High Tension Porcelain Insulators, A. D. Allen. Contract Rec., vol. 35, no 32, August 10, 1921, pp 729-731, 3 figs. Describes processes of manufacture and care required in inspection.

INTERNAL-COMBUSTION ENGINES

Cycle Evaluating Chart. A Nomographic Chart for Gases, T. B. Morley. Engineering, vol. 112, no. 2901, Aug. 26, 1921, pp. 302-304, 5 figs. Chart developed by author for evaluating with ease and rapidity internal-combustion-engine cycles, which yields approximate results, claimed to be preferable to "standard" values.

Installation. Practical notes on the Installation and Running of Petrol, Petrol-Paraffin, and Smi-Diesel Engines, D. P. Lamb. Mech. Wld., vol. 70, no. 1864, July 29, 1921, pp. 91-92. Discusses, reverse gear, exhaust pipe, circulating pumps, gear pumps and fuel-supply system. (To be continued)

Large-Cylinder. Internal Combustion Engines with Large Cylinders, James McKechnie. Gas & Oil Power, vol. 16, no. 191, August 4, 1921, pp. 173-174. Discusses requirements of mercantile ships, electric drive, two stroke design, and gives table of test data of 1000-b. hp single-cylinder engine. From paper read before Instn. Civil Engrs.

Operation. Practical Notes on the Installation and Running of Petrol, Petrol-Paraffin and semi-Diesel Engines, D. P. Lamb. Mech. Wld., vol. 52, no. 1865, August 5, 1921, pp. 112-115, Discusses carburetors, lubrication, magnetos, water circulation, etc. Paper read before Instn. Mar. Engrs.

See also Aeroplane Engines; Automobile Engines; Diesel Engines; Oil Engines Semi-Diesel Engines.

IRON

Foundry. Foundry Irons for Particular Uses, Y. A. Dyer. Iron Age, vol. 108, no. 10, Sept. 8, 1921, pp. 585-588. Differentiating characteristics of gray iron, mottled, chilled or white. Analyses of certain casting.

IRON ALLOYS

Iron-Nickel. Making a 5-per cent. Nickel-cast-iron Alloy in an Electric Furnace D. N. Witman. Trans. Am. Inst. Min. & Met. Engrs., no. 1087-S, August 1921, 4 pp. 1 fig. Discusses different alloys used for production of electrical-resistance girds.

Iron-Silicon System. On the Equilibrium Diagram of Iron-Silicon System, Takejifo Murakami. Science Reports, Tôkohu Imperial Univ., vol. 10, no. 2, June 1921, pp. 79-92, 26 figs. Description of experiments carried out resulting in a revision of the equilibrium diagram by Guertler and Tammann.

IRON CASTINGS

Chill Castings. Chill Castings (Le Moulage en Coquille), A. Dat. Arts et Métiers, vol 74, no. 9, June 1921, pp. 167-170, 11 figs. Discusses making of mold, pouring under pressure, etc.

Nickel and Cobalt in. Nickel and Cobalt in Iron, O. Bauer and E. Piwowarsky. Iron Age, vol. 108, no. 9, Sept. 1, 1921, p. 513. German experiments on iron castings; nickel improves physical properties. Translated from Stahl u. Eisen, Sept. 30, 1920.

L

LABOR

Hours of Work and Output. Hours of Work and Output. Eng. & Ind. Management, vol. 6, no. 5, August 4, 1921, pp. 122-124. Annual report of British Chief Inspector of factories and workshops.

Loss, Sources of. The Sources of Labor Loss, J. Burk LeClere. Indus. Management, vol. 62, no. 3, Sept. 1, 1921, pp. 177-181. How they affect production through man power.

LABOR TURNOVER

Accidents in Relation to. The Unexpected Trend in Accident Prevention C. B. Auel Management Eng., vol. 1, no. 1, July 1921, pp. 35-41, 2 figs. Long service, good Health, contentment, cleanliness, and carefulness are said to be more important than mechanical devices.

LIGHTING

Canneries. Solving Special Light Problems in the Modern Cannery. Warren Alden. Jl. Electric & Western Ind., vol. 47, no. 4, August 15, 1921, pp. 145, 1 fig. Describes illumination in plant of Pratt-Low Preserving Co., Santa Clara, Cal.

LIGHTNING ARRESTERS

Types. Lightning Arresters on Overhead Power Systems, Alfred Still. Elec. Rev., (Chicago), vol. 79, no 6, August 6, 1921, pp. 192-196, 4 figs. Discusses multigap, electrolytic and oxide film apparatus.

LIME

Kilns. Some New Features in Limekiln Construction, Richard K, Meade. Jl. Ind. & Eng. Chem., vol. 13, no. 8, August 1921, pp. 722-727, 5 figs. Discusses improvements in design of flame and rotary kilns, especially combustion.

LUBRICATING OILS

Specifcations. Lubricating Oil Temperature Charts. Gas Age-Rec., vol. 48, no. 5, August 20, 1921, pp. 201-202, 2 figs. Show effect of viscosity on lubrication oils; gives specifications for selceting oils.

LOCOMOTIVE BOILERS

Tubes. Steel vs Brass Locomotive Boiler Tubes. (Le Tube de Chaudière de Locomotive acier ou laiton?), O. Hock. Revue Universelle des Mines, vol. 10, no. 3, August 1, 1921, pp. 261-269. Discusses experiences in various countries and shows that steel tubes are more economical.

LOCOMOTIVES

Oil-Burning. Liquid-Fuel Burning Locomotives on British Railways-I. Ry. Engr., vol. 42, no. 499, August 1921, pp. 304-310, 11 figs. Describes recent developments with various companies. (To be continued).

Tires, Machining. Tools for Boring and Turning Locomotive Tires-II, Fred H. Colvin. Am. Mach., vol. 55, no. 8, Aug. 25, 1921, pp. 313-317, 21 figs Rough and finish turning tools. Solid tools and tools in holders. Angles of rake and clearance are said to vary greatly in different shops.

M

MACHINE DESIGN

Errors, Causes of. Common Causes of Errors in Machine Design R. H. McMinn. Machy. (N. Y.), vol. 28, no. 1, Sept. 1921, pp. 38-39, Instructions and standards. Convenient form for data. Attitude toward errors. (Concluded.)

MACHINE GUNS

Barrels, Life of. Some Factors Affecting the Life of Machine-Gun Barrels. W. W. Svesbnikoff. Dept. Commerce, Technologic Papers Bur. Stand. no. 191, June 4, 1921, 27 pp. 19, figs. Results of experiments show that deterioration is due to combination of abrasive action of bullet and abrasion by hot gases.

MACHINERY

Vibration. Elimination of Machine Vibration. Indian Ind. & Power vol. 18, no. 10, June 1921, pp. 529-531, 5 figs. Explains origin of vibrations and shows how to overcome them.

MALLEABLE IRON

American Foundry Practice. American Malleable Cast Iron-XIV-XVIII, H. A. Schwartz. Iron trade Rev., vol. 69, nos. 2, 4, 6, 8 and 10. July 14-28, Aug. 11-25, and Sept. 8, 1921, pp. 98-101, 2 figs., 233-238, 8 figs, 354-359, 4 figs., 490-499, 3 figs. and 611-616, 9 figs. July 14: Cupola and open-hearth melting. July 28: Annealing practice. Aug. 11, Metallurgy of annealing. Aug. 25: Patternmaking and molding. Sept. 8: Cleaning and finishing.

MANUFACTURING

Special Tools vs. Standard Equipment. Manufacturing With Special Machines vs. Standard Equipment,-IV, F Jenks and M. H. Christopherson Am. Mach., vol. 55, no. 9, Sept. 1, 1921, pp. 349-353, 13 figs. Portable devices for plain and thread milling. An angular drilling fixture. Special machine for milling sinuous oil grooves.

MARINE STEAM TURBINES

Geared. Geared Marine Turbines, C. R. Waller. Am. Mar. Engr., vol. 16, no. 10, May 1921, pp. 11-13, 4 figs. Gives description of type built by De Laval Steam Turbine Co.

MATERIAL HANDLING

Modern Methods The Moving of Materials in Industry, R. M. Gates. Management Eng., vol. 1, no. 2, Aug. 1921, pp. 65-70, 9 figs. Suggestions for better and greater application of mechanical material-moving devices.

MATTER

Changes of Form. Crystals, Solids and Vitreous Matter, A. Portevin Sci. Am. Monthly, vol. 4, no. 2, Aug 1921, pp. 137-141, 6 figs. Basic principles and general phenomena relating to changes of form in matter. Translated from La Revue de l'Ingénieur, April, 1921.

MEASURING INSTRUMENTS

Electric Sensitive. Sensitive Measuring Apparatus, J. B. Moran. Machy. (N.Y.) vol. 28, no. 1, Sept. 1921, pp. 36-37, 2 figs. Describes electrical measuring device which is sensitive go one two- hundred millionths of an inch.

METALS

Calorizing. Protection of Metals by Calorizing (La Protection des Métaux par la Calorisation). Le Génie Civil, vol. 79, no. 6, August 6, 1921, pp. 131-132, 3 figs. Discusses principles, advantages and difficulties of process.

MILLING MACHINES

Pressures Exerted by Cutters. Determining Pressures Exerted by Cutters. Can. Machy., vol 26, no. 4, July 28, 1921, pp. 33 and 35, 3 figs. Describes device indicating pressures exerted on various parts of milling machine.

MINER'S LAMPS

Types. Approved Safety Lamps For Mines. Colliery Guardian, vol. 122, no. 3160, July 22, 1921, pp. 241-242, 5 figs. Describes various safety lamps approved by British Board of Trade.

MINING ENGINEERING

Foreign Exploration. Training for Foreign Exploration, H. Foster Bain. Bul. School Mines & Metallurgy, Univ. Mo. vol. 13, no. 3, June 1921, pp. 3-15. Discussion of the prospects of the profession of mining engineering.

MOLYBDENUM STEEL

Uses. Molybdenum Steel Uses Increase, M. H. Schmid. Iron Trade Rev., vol. 69, no. 9, Sept. 1, 1921, pp. 559-561. Use in manufacture of automobiles and other applications. Tests show properties of various alloys. (Abstract.) Paper presented before Am. Soc. for Steel Treating.

MONEL METAL

IMPACT TESTS. Note on Notched Bar Impact Tests and Toughness of Monel Metal, H. G. Waltenberg, Chem. & Met Eng, vol 24, no. 8, August 24 1921, pp. 322-323. Gives details of Charpy and Izod tests

MOTOR BUSES

RAILWAY-TRACK Motor Omnibus For Railway Service. Tramway & Ry. Wld., vol 50, no 9, August 18, 1921, pp. 70-71, 4 figs Built by J. G Brill Co. for Chesapeake Western R R Is a one-man bus

MOTOR-TRUCK TRANSPORTATION.

COMPARISON WITH RAILWAYS. The Motor Truck and the Railroad, Rollin W. Hutchinson. Indus. Management, vol. 62, no 3, Sept. 1, 1921, pp. 131-138, 4 figs. A forecast of future of motorised high-way commerce.

MOTOR TRUCKS

STEAM. The Clarkson Steam Lorry. Engineering, vol 112, no 2903, Aug. 19, 1921, pp 275-278, 12 figs. New type of vehicle which burns coke Details of engine, boiler, etc

O

OIL ENGINES

DOUBLE-ACTING TWO-STROKE MARINE. The First Motor Ship with Double-Acting Two-Stroke Engines, R. Dreves. Engineer, vol. 132, no. 3425, Aug 19, 1921, pp. 191-192, 1 fig. Describes engines installed on twin-screw cargo vessel, Fritz, having three working cylinders of 480 mm. diam. and 710 mm. stroke, and developing 830 brake hp. at 120 hr.p.m Account of trial tripts with ship which was delivered to England in November, 1919, according to terms of Peace Treaty.

MARINE. Some observations on Marine Oil Engines, D. M. Shannon. Mech. Wld., vol. 52, no. 1807, August 19, 1921, pp. 143-144, 11 figs. Discusses Diesel and hot-bulb engines. (To be continued.) From paper read before Inst. Mar. Engrs.

OIL WELLS

PRODUCTION. Some Principles Governing the Production of Oil Wells, Carl H. Beal and J. O. Lewis. Petroleum Times, vol. 6, no. 135, August 6, 1921, pp. 183-185,. Discusses natural and artificial influences in yield of wells. (To be continued.)

OXY-ACETYLENE CUTTING

RADIOGRAPH AND OXYGRAPH MACHINES. Oxy-Acetylene Cutting Machines. Engineering, vol. 112, nos. 2903, 2904 and 2905, Aug. 19, 26 and Sept. 2, 1921, pp. 274-275, 307-311 and 356-357, 30 figs. Constructed by Davis-Bournonville Co., Jersey City N. J. Aug. 19: Details of the radiograph machine for cutting metal up to 20 or 22 in. thick in straight lines or to circular profiles. Aug. 26 and Sept. 2: The oxygraph machines nos. 1A and 2A.

P

PAINTS

WHITE LEAD. White Lead in Painting. Engineering, vol. 112, no. 2904, Aug. 26, 1921, pp. 323-324. Outline of statement issued by London Chamber of Commerce entitled Case Against Prohibition, in connection with subject to be discussed at Int. Labor Conference at Geneva, Oct. 25 on the prohibition of use of white lead in painting.

PATENT LAWS

NEEDED IMPROVEMENTS. The Patent Situation, Edwin J, Prindle. Chem, & Metallurgical Eng., vol. 25, no. 9, Aug. 31, 1921, pp. 417-419. Claims that inadequate salaries and insufficient personnel are causes of waste in patent office for which industry must pay in costly delays and burden some litigation. Analysis of legislation designed to remedy situation.

PAVEMENTS

ACCELERATED WEAR TESTS. Accelerated Wear Tests by the Bureau of Public Roads, F. H. Jackson. and C. A. Hogentogler. Pub. Roads, vol. 4, no. 2, June 1921, pp. 3-21, 13 figs. Results of tests upon granite-block, vitrified-brick and concrete pavement surfaces, for purpose of comparing behavior of various forms of the several types when subjected to exceptionally heavy steel-tired traffic, and of ascertaining whether resistance to wear of constituent parts may be considered as reliable index of wearing value of these materials when combined in pavement, Description of testing machine and methods.

PAVEMENTS, CONCRETE

CAR TRACKS. Concrete Pavement for City Street with Car Tracks, C R. Ege Eng Wld., vol 19, no 2, August 1921, pp. 97-100, 6 figs Shows that concrete pavement for car tracks can be very successfully applied and will give a street surface particularly adapted to modern motor traffic

PETROLEUM

DISTILLATION Mineral Oil Distillation Petroleum Wld., vol 18 no 251, August August 1921, pp 313-320, 4 figs Discusses questions of dephlegmation and preheating (To be continued)

REFINING. Minimizing Heat Losses in Oil Refining, Min & Oil Bul, vol 7 no 9, August 1921, pp. 537-539 and 563, 4 figs Discusses high-temperature heat insulators as applied to various stills.

The Refining of Petroleum, C K Francis, Min. & Oil Bul., vol 7, no 9. August 1921, pp. 521-528 and 563, 2 figs. Discusses fractional distillation gasoline, naphtha, lubricating oils, wax, petrolatum etc

PILES

CONCRETE. Systems of Concrete Piles. Eng. Wld., vol. 19. no 2. August 1921, pp. 81-85, 3 figs. Describes kinds of concrete piles made by a number of contracting firms.

PRESERVATION OF TIMBER Timber Piling in Waters Infested by Marine Borers. Engineer, vol. 132, nn. 3420, July 15, 1921, pp. 57-58 Results of investigations by special committee appointed by Am. Wood Preservers' Assn. and U S. Forest Products Laboratory to study destructive effects of wood-boring insects upon timber piles in San Francisco Bay.

PIPE LINES

WOOD-STAVE. Wood Pipe Lines in New England Hydroelectric Development. Elec. Rev. (Chicago), vol. 79, no. 8, August 20, 1921, pp. 265-268, 8 figs Also in Eng. Wld., vol. 19, no. 2, Aug. 1921, pp. 77-80, 8 figs. Some data on recent wood-stave constructions.

PISTONS

MACHINING. Machining One Hundred Engine Pistons per Hour. J. H Moore. Can. Machy., vol. 26, no. 6, August 11, 1921, pp. 25-27, 12 figs Examples of work produced including valve stem guide, engine valve cage, etc.

PLANERS

MECHANICAL REVERSING DRIVE. A Mechanical Reversing Drive for Planning Machines. Engineer, vol. 132, no. 3422, July 29, 1921, pp. 124-125, 3 figs. Details of the Newton-Derby patented reversing drive.

PORCELAIN

PHYSICAL PROPERTIES. The Physical Prpperties of Porcelain. (Die physikalischen Eigenschaften des Porzellans). F. Singer and E. Rosenthal. Sprechsaal, vol. 54, no. 22, June 2, 1921, pp. 250-251. Notes on melting capacity, specific weight, coefficients of expansion, compressive heat capacity modulus of elasticity, hardness, compressive tensile and bending strength, optical and electrical behavior, etc. (Abstract.) Report of German Ceramic Soc.

PORTS

EQUIPMENT. Docks and Harbours: General Structural Lay-Out, Systems of Control, Operation, and Gharges, D. J. Owen. Jl. Inst. Transport, vol. 2, no. 6, May 1921, pp. 279-288. Discusses also constitution of port authorities, function of ports, handling appliances, loading and unloading of vessels, port charges, etc.

POTASH

RECOVERY FROM CEMENT DUST. The Successful Recovery of Potash as a By-product From Cement Kilns, Christian Krarup. Chem. & Met. Engr. vol. 25, no. 8, August 24, 1921, pp. 316-320, 2 figs. Description of plant in which cement dust is separated from potash by spray washers prior to electrical precipitation.

POWER PLANTS

DEVELOPMENTS. Developments in Power Station Design-V. Engineer, vol. 132, no. 3425, Aug. 19, 1921, pp. 190-191, 4 fihs. Details of the Bettington boiler arranged for burning pulverized coal, comstructed by Fraser & Chalmers, Ltd.

INDUSTRIAL. Industrial Power-Plant Data. Power vol. 54, no. 4, July 26, 1921, pp. 139-140. Census figures from 26 states covering primary power in manufacturing establishments.

PRECIPITATION

ELECTRICAL. Eliminating Waste and Nuisance in Smoke, Fume and Gas, P. E. Landolt. Chem. & Metallurgical Eng., vol. 25, no. 9, Aug. 31, 1921, pp. 428-432, 6 figs. Notes on electrical-precipitation methods in metallurgical, and chemical industries, and in other fields. Costs. Bibliography.

Extracting Flue Dust Electrically, N. H. Gellert,. Iron Trade Rev., vol. 69, no. 2, July 14, 1921, pp. 102-105, 3 figs. Describes principle involved in precipitating dust by Cottrell process and method of operating an electrolytic cleaner. Comparison of various types of gas-cleaning equipment. (Abstract.) Paper presented before Assn. Iron & Steel Elec. Engrs.

PRESSES

Safeguarding. Safety Devices for Power Presses. Machy. (N. Y.), vol. 27, no. 12, Aug. 1921, pp. 1106-1109. and vol. 28, no. 1, Sept. 1921, pp. 40-42, 16 figs. Guards and safety measures provided for power press equipment in Cleveland Metal Products Co's plant, Cleveland, Ohio.

PRESSWORK

Tools. An Interesting Press Job. Eng. Production, vol. 3, no. 47, Aug. 25, 1921, pp. 173-174, 10 figs. Tools for producing curtain holders.

PROFIT SHARING

British Plan. British Plan of Profit Sharing, T. Sington. Am. Gas Jl., vol. 115, no. 8, August 20, 1921, pp. 165-166. Discusses method adopted by gas companies.

Boiler Firing. Firing With Pulverized Coal (La Chauffage au Charbon Pulvérisé), Paul Frion. Chaleur et Industrie, vol. 2, no. 15, July 1921. pp. 433-439. Discusses application of pulverized coal for furnaces and steam generator. also its drawbacks and dangers. (Concluded.)

Use of Pulverized Coal in Steam Power Plants, H. A. Reichenbach. Elec. Rev. (Chicago), vol. 79, no. 8, August 20, 1921, pp. 261-264, 5 figs. Method employed in handling and preparing fuel for delivery to furnace. Pipe line used to convey pulverized coal 1000 ft. Some tests results with anthracite silt and bituminous coal.

Power Stations. Developments in Power Station Design. Engineer, vol. 132, nos. 3420, 3421, 3423 and 3424, July 15, 22, Aug. 5 and 12, 1921, pp. 70-71, 90-91, 142-144 and 162-163, 11 figs. Notes on by-products and waste heat, and pulverized coal. Different types of pulverized fuel plants, installed in English and American power plants.

R

RAILS

Rerolling Discarded Steel. Rerolling Discarded Steel Rails, John D. Knox. Iron Trade Rev., vol. 69, no. 4, July 28, 1921, pp. 226-231, 10 figs. Practice as followed by Sweet's Steel Co. in preparing broken sections for mills. Descriptions of plant.

RAILWAY ELECTRIFICATION

Advantages. The Electrification of Main Line Railways in Relation to Traffic Working Philip Nash. Jl. Inst. of Transport, vol. 2, no. 5, March 1921, pp. 194-202 and Discussion pp. 202-207. Discusses pros and cons of electicity and steam for freight haulage

RAILWAY MOTOR CARS

Gasoline. Petrol Rails Cars for India, Engineer, vol. 132, no. 3419, July 8, 1921, pp. 44-45, 5 figs Describes 2-ft. 6-in-gage 50-hp. petrol cars built for Kalka-Simla Railway by Drewry Car Co., Ltd , London.

RAILWAY OPERATION

Automatic Train Control. Problems of Automatic Train Control. Ry. Engr., vol. 42, no. 499, August 1921, pp. 311-315. Discusses various problems and cost of installation, principles of communication, etc.

Ceylon. The Ceylon Government Railways-II. Ry. Gaz., vol. 35, no. 6, August 5, 1921, pp. 257-258. Abstract from British government report on administration and working of railroad. (To be Concluded.)

Economics. Economics of Railway Transport, and Methods of Raising Revenue, J. George Beharrell. Jl. Inst. of Transport, vol. 2, no. 5, March 1921, pp. 218-232, 7 figs. Discusses density of traffic, revenue and costs, rate-fixing machinery, commodity ton miles, etc.

Slow-Freight Traffic. On the Question of Slow Freight Traffic, U Lamalle. Bul. International Ry. Assn., vol. 3, no. 7, July 1921, pp. 857-884, 10 figs. Discusses freight wagons, organization of train services, influence of rating on working capacity of rolling stock.

RAILWAY REPAIR SHOPS

Methods. Railway Machine Shop Practice. Machy. (N. Y.), vol. 27, no. 12, Aug. 1921, pp. 1098-1099, 5 figs. Methods of procedure in making common types of repairs that are required on passenger and freight cars.

Tools. Forge Shop and Other Railroad Shop Tools, Frank A. Stanely. Am. Mach., vol. 55, no. 9, Sept. 1, 1921, pp. 354-356, 11 figs. Tools and methods in use in western railroad shop Special equipment to utilize air. Modern method of cleaning castings.

RAILWAY TRACK

Maintenance. Effect of Train Speed on Cost of Track Maintenance, C. C. Williams and J. M. Burt,. Eng. & Contracting, vol. 56, no. 7, August 17, 1921, pp. 152-155. Discusses behavior of track in case of freight trains, increased expense etc. (Abstract.) Sub-committee report on economics of Ry. operation of Am. Ry. Eng. Assn.

Note on Mechanical Permanent Way Repairing Plant, M. Cartault. Engineering, vol. 112, no. 2903, Aug. 19, 1921, pp. 281-282. Describes use and mechanical equipment of the Collet system, in use since 1901 on Paris, Lyons & Mediterrenean Ry. permanent way. Reprinted from Bul. Int. Ry.Assn.

Roadbed. On the Question of the Construction of theRoad Bed and of the Track, Charles H. Ewing. Bul. International Ry. Assn., vol. 3, no. 7, July 1921, pp. 835-856, 11, figs. Discusses questions of ballasts, rails, tie plates, etc. and gives list of replies received from railway companies to a question blank.

RAILWAY YARDS

Illumination. Correct Illumination of Railway Freight Yards, J. H. Kurlander. Ry. Elec. Engr., vol. 12, no. 8, August 1921, pp. 299-306, 13 figs. Also in Ry. Age, vol. 71. no. 8, Aug. 20, 1921, pp. 337-340, 9 figs. Mounting height of lighting units is of prime importance in eliminating glare and obtaining best results. Bibliography.

REDUCTION GEARS

Heliocentric. The Heliocentric Reduction Gear Machinery (Lond.) vol. 18, no. 464, August 18, 1921, pp. 598-599, 3 figs. Describes new type of speed-reducing gear invented by W. C Pitter and manufactured by Central Gear Co., Lond.

REFRACTORIES

Jointing Materials for. Notes on Jointing Materials for Refractories, L. Bradshaw and W. Emery. Gas Jl., vol. 155, no. 3036, July 20, 1921, pp. 157-159, 1 fig. Discusses jointing materials for refractories and influence of oxidizing and reducing atmospheres on refractory materials.

REFRIGERATING PLANTS

Electric-Motor Drive. Electric Motors for Driving Refrigeration Plants-Their Types, Characteristics, and Selection. W. H. Motz. Power, vol. 54, no. 6, Aug. 9, pp. 208-211, 5 figs. Discusses use of compound and synchronous motors.

REFRIGRATING MACHINES.

Carbon-Dioxide. Refrigerating Machines (Machines Frigorifiques), A. Rullier. Arts et Métiers, vol. 74, no. 8, May 1921, pp. 150-153, 5 figs. Describes recent improvements in CO_2 machines.

ROLLING

Non-Metallic Products. The Rolling of Nom-Metallic Products, Morris A. Hall. Raw Material, vol. 4, no. 8, August 1921, pp. 273-278, 9 figs. Dicusses kinds of rolls in use in paper, textile and other non-metallic industries.

ROLLING MILLS

Roll Making. How Steel Mill Rolls Are Made-II, H. E. Diller. Foundry, vol. 49, no. 16, August 15, 1921, pp. 631-638, 15 figs. Discusses metallurgy, melting and casting practice.

RUBBER

Technology. Rubber-From the Sap to the Finished Product, W. H. Holmes. Raw Material, vol. 4, no. 8, August 1921, pp. 281-289, 8 figs. Discusses principle rubber products: washing, drying and grinding machines; rubberized cloth; waterproofing, etc.

Vulcanized, Hardness of. The Modulus of Hardness of Vulcanized Rubber, H. P. Gurney. Jl. Ind. & Eng. Chem., vol. 13, no. 8, August 1921, pp. 707-712, 11 figs. Describes spring type and dead weight type of instruments for determining hardness.

S

SCIENTIFIC MANAGEMENT

See Industrial Management.

SCRAP

Losses Regulating. Regulating Losses from Scrap, Herbert R. Simonds. Iron Trade Rev., vol. 69, no. 3, July 21 1921, pp. 157-161, 10 figs. Distinguishing between avoidable and unavoidable waste. Change in design often reduces scrap loss. Proper marketing.

SEMI-DIESEL ENGINES

Operation. Semi-Diesel Engines (Les Moteurs Semi-Diesel). La Nature no. 2463, June 18, 1921, pp. 395-398, 2 figs. Describes method of working generally and combustion chamber in particular.

SEWAGE DISPOSAL

Activated Sludge. Activated Sludge Process for Industrial Wastes and Sewage Harrison P. Eddy. Eng. Wld., vol. 19, no. 2, August 1921, pp. 112-117'. Touches briefly on most interesting features of this process and points out facts ascertained and those still requiring investigation.

Large Scale Activated Sludge Plant at Woodstock, Ontario, W. G. Ure. Can. Engr., vol. 41, no. 5, Aug. 4, 1921, pp. 1 and 7, 5 figs. With capacity 1,500,000 gal. daily, it serves 9000 population. Cost $58,000.

Lights and Shadows of the Activated Sludge Process, Harrison P. Eddy. Public Works, vol. 51, no. 6, Aug. 6, 1921, pp. 112-115. Developments up to date. Description of process, theory of its operation, extent of purification accomplished, effect of temperature, re-aeration and other details. Pape read before West. Soc. Engrs. (To be continued.)

Current Practice. Current Tendencies in Sewage Disposal Practice, George W. Fuller. Jl. Western Soc. Engrs., vol. 26, no. 8, August 1921, pp. 273-288. Discusses relation to water supplies and to trade wastes, also utilisation of sewage, sedimentation tanks, and sludge processes.

Settling Tanks, German. German sewage Settling Tanks with Separate Sludge Digestion, M. B. Tark. Eng. News-Rec., vol. 87, no. 9. Sept. 1, 1921, pp. 369-370, 4 figs. Discusses the Kethen Neustadt and Kremer-Kusch tanks. Points out that latter have been installed in number of German cities and have given uniformly good results.

SLAG

Blast-Furnace. Methods of Preparing Blast Furnace Slag. Iron Age, vol. 108, no. 8, Aug. 25, 1921, pp. 461-463, 1 figs. Divided into four classes by Carnegie Steel Co. according to specific use to which it is to be put.

SLOTTING

Machines for. Slotting Operations on Production Work. Machinery, (Lond.) vol. 18, no. 464, August 18, 1921, pp. 604-609, 12 figs. Discusses vertical planing, shaping, slotting and keyseating operations.

SPRINGS

Leaf. Formulas for Calculating Leaf Springs (Détermination de Formules Pratiques pour le Calcul des Ressorts à Lames), H. Chaullet. Arts et Métiers, vol. 74, no. 8, May 1921, pp. 145-149, 7 figs. Works out formulas for various kinds.

STANDARDIZATION

German N. D. I. Report. Report of the German Industry Committee on Standards (Mitteilungen des Normenausschusses der Deutschen Industrie). Betrieb, vol. 3, no. 20, July 10, 1921, pp. 299-315, 23 figs. Proposals of Board of Directors for cotters; round threads; hexagonal and square-head bolts and nuts, carriage and countersunk bolts, lag screws, etc. Proposed standards for double anchor plates for T-head anchor bolts; wall anchor plates: T-head bolts: square nuts for anchor bolts, paper sizes, etc.

STEAM

Flow in Pipes. Convenient Tables for Steam Flow in Pipes, V. F. Davis. Power vol. 54, no. 4, July 26, 1921, pp. 144-145. Table giving steam flow in pounds per minute for 100-ft. pipe and 1-lb. pressure drop; and factors to be applied to table for various lengths and pressure drops.

STEEL

Alloy. *See Alloy Steels.*

Classification Code. Universal Steel Classification Code, Horace C. Knerr and Arthur L. Collins, Iron Age, vol. 108, no. 9, Sept. 1, 1921, pp. 515-517. Proposed new code to supplant present S. A. E. system. Claimed to be simpler, more elastic and easily expanded.

Drill. Manufacture of Drill Steel from Hollow Ingots. P. A. E. Armstrong. Iron Age, vol. 108, no. 10, Sept. 8, 1921, pp. 596-598, 2 figs. Process use by Ludlum Steel Co. and its advantages. (Abstract of paper read before Am. Inst. Min. & Metallurgical, Engrs., with additional details and illustrations.

Endurance. Relations Between The Physical Properties of Steels and Their Endurance of service Stresses, James E. Howard. Trans Am. Soc. for Steel Treating vol. 1, no. 11, August 1921, pp. 673-682. Discusses state in which steel best meets the conditions of service.

Ingots, Welding Defective. Welding Defective Steel Ingots, H. Brearley. Iron Trade Rev., vol. 69, no. 5, Aug. 4, 1921, pp. 289-292. Discusses blow-holes and segregate effect. Explains test method for determining extent of interior influences. Method of casting ingot is said to regulate imperfections. Paper read before Iron & Steel Inst.

Molybdenum. *See Molybdenum Steel.*

Silicon Additions. Silicon Additions to Steel. Iron Age, vol. 108, no. 8, Aug. 25, 1921, p. 4581. Effect of early and late introduction on gas content and rolling discard. Translated from article by Piwowarsky in Stahl u. Eisen, June 10, 1920.

Tool. *See Tool Steel*

STEEL CASTINGS

Electric vs Open-Hearth Furnaces. Compares Costs of Melting Steel. Iron Trade Rev., vol. 69, no. 3, July 21, 1921, pp. 167-170, 3 figs. Producer of steel castings operating both an electric and an open-hearth furnace gives data covering the two processes from which estimated costs are calculated.

STEEL FOUNDING

Converter Flame Examination. Spectroscopic Examination of Converter Flame W. J. Campbell. Engineer, vol. 132, no. 3423 Aug. 5, 1921, pp. 137-138. Notes on the spectroscope and advantage of its use for many classes of small foundry work. Table giving outline of average blow and its spectroscopic examination.

STEEL, HEAT TREATMENT OF

Effect on Fatigue Strength. Effect of Heat treatment on the Fatigue-Strength of Steel, E. R. Stenger and B. H. Stenger. Trans Am. Soc. Steel Treating, vol. 1, no. 11, August 1921, pp. 617-635 and Discussion pp. 635-638, 15 figs. Discusses effect of cold rolling and cold drawing, also effect of carbon content.

Temperature and Quality. The Carbonizing Process. Relation of Temperature to Quality of Cast and Core, Theodore G. Selleck. Trans. Am. Soc. Steel Treating, vol. 1, no. 11, August 1921, pp. 655-665, 9 figs. Gives a number of heat-treatment curves.

STEEL MANUFACTURE

American vs. English Pratice. British View of American Steel Making, R. Percival Smith. Iron Age, vol. 108, no. 10, Sept. 8, 1921, pp. 589-591. Blast-furnace and open-hearth practice compared. Coke-Oven gas as fuel. Rolling mills in United States and England. (Abstract.) Paper read before West of Scotland Iron & Steel Inst.

Bessemer Process. The Bessemer Process For Making Steel, Arthur P. R. Wadlund. Trans. Am. Soc. for Steel Treating, vol. 1, no. 11, August 1921, pp. 682-689, 1 fig. Shows that the basic process is much more expensive than the acid process.

SUBSTATIONS

Layout. Simplified Layout of Rotary-Converter Substation, J. E. Woodbridge. Elec. Wld., vol. 78, no. 8, August 20, 1921, pp. 361-365, 3 figs. Describes 4000-kw. substation recently completed in San Francisco and shows saving effected.

SUPERHEATERS

Performance. Steam Superheaters, Arthur D. Pratt. Jl. Engrs. Club of Phil., vol. 38, no. 200. August 1921 pp. 291-299 and Discussion pp. 299-308. Discusses construction and performances.

SWAGING

Cold. Methods Employed in Making Swaging Dies. Machinery (Lond.), vol. 18, no. 461, July 28, 1921, pp. 503-505, 8 figs. Subject of cold swaging.

T

TELEPHONY

Long-Distance. Europe. Long-Distance Telephony in Europe (La téléphonie à grande distance en Europe). M. G. Martin. Annales des Postes, Télégraphes et Téléphones, vol. 10, no. 2, June 1921, pp. 263-270. Compares American and European conditions, showing European lack of organization.

THERMIONIC VALVES

Application to Telephony. Notes on the Audion and its Application, H. B. Sherman. Jl. Eng. Inst. Can., vol. 4, no. 8, Aug. 1921, pp. 456-459, 5 figs. Developments of thermionic valve and its application to telephony.

TIME STUDY

Drop-Forge Shop. Eliminating Unproductive Time in Industry. Eng. & Indus. Management vol. 6, no.8, Aug. 25, 1921, pp. 205-207, 2 figs. Possible increase in production is emphasized by example of the drop-forge shop at Mare Island Navy Yard.

Human and Mechanical Elements of Work. Measuring the Human and Mechanical Elements in Manual Work L. Arthur Sylvester. Indus. Management, vol. 62., no. 3, Sept. 1, 1921, pp. 141-144. Discusses natural relation between time and human labor.

Organization. How to Conduct a Time Study Organization, Chester D. Buoy. Indus. Management, vol. 262, no. 2, Aug. 1, 1921, pp. 101-105. Notes on purpose of time-study department, and qualifications for a time study man.

Standard Time. "Standard Time" in Planning and Production, Waldo Lyon. Management Eng. vol. no. 2, Aug. 1921, pp. 105-108, 5 figs. How it is used to eliminate delays, estimate output and compare results of machine and department operation.

TOOL STEEL

Specifications. Standardizing Specifications For Tool Steel, Charles M. Brown. Trans. Am. Soc. for Steel Treating, vol. 1, no. 11, August, 1921, pp. 666-672. Discusses specifications in use, also content of tungsten, vanadium, phosphorus, etc.

TRAIN HEATING

Electric Trains. Steam-Heating Electric Trains in Switzerland, William A. Rosenberger. Elec. Ry. Jl. vol. 58, no. 6, August 6, 1921, pp. 206-207 2 figs. Single phases current at 15,000 volts is applied directly to water in specially designed boiler.

TRANSFORMERS

Protection. Guarding Transformers and Rotaries from Overload and Entire Installation from Lightning and Surges, B. F. Grimm. Coal Age, vol. 20, no. 8, August 25, 1921, pp. 291-295, 6 figs. Discusses Transformer fuses and four lightning and surge arresters and their advantages.

TRANSPORTATION

Interdependence of Various forms. Interdependence of the Various Forms of Transport, Philip Burtt. Jl. Inst. of Transport, vol. 2, no. 5, March 1921, p. 233-247, 2 figs. Discusses ocean transport and railway traffic, light and heavy railways, inland waterways and other forms of transport.

V

VALVES

Gate, Electrically Operated. Electrical Operation of Gate Valves, Payne Dean. Fire and Water Eng., vol. 70, no. 8, Aug. 24, 1921, pp. 343-344, 4 figs. Value of quick electrical control through special devices. Description of control system.

VENTILATION

Duct Systems. The Meier Chart, A. C. Pallot. Domestic Eng., vol. 41, no. 32, August 1921, pp. 115-120, 3 figs. Describes method of designing ventilation duct systems.

W

WAGES

Incentive vs. Production Basis. Incentive or Production Basis of Wage Payment-III, Henry H. Farquhar,. Am. Mach., vol. 55, no. 9, Sept. 1, 1921. pp. 344-348, 3 figs. Assignment and recording of production; co-operation with workman; fitting system to conditions; co-operation of excutives.

Premium System. The Premium Wage Payment System, C. B. Lord. Management Eng. vol. 1, no. 2, Aug. 1921, pp. 108-110. Principles and advantages of Halsey premium system.

Rate Determination. An Analytic Method for Determining Wage Rates, Edward Peterson. Management Eng. bol. 1, no. 3, Sept. 1921, pp. 146-148. Notes on determination of day-work and piece-work rates.

WARFARE

Incendiary. Incendiaries in Modern Warfare, Part II, Arthur B. Ray. Jl. Ind. & Eng. Chem., vol. 13, no. 8, August 1921, pp. 714-722, 27 figs. Description of shells, bombs, flame projectors, etc.

WASTE ELIMINATION

Automatic Machinery, use of. Eliminating Manufacturing Waste With Machinery. J. E. Hires. Chem, & Metallurgical Eng., vol. 25, no. 9, Aug. 31, 1921, pp. 410-412. Recognition of importance of engineering research and extensive use of automatic machinery as means of eliminating wastes in labor, time and materials.

Industrial. The Elimination of Construction Wastes, George W. Burpee. Chem. & Metallurgical Eng., vol. 25, no. 9, Aug. 21, 1921, pp. 394-396. Comprehensive dollars-and-cents analysis of preventable wastes in construction industries and thorough understanding of responsibility imposed upon contractor owner, architect, engineer and workman.

Metal Trades Industry. Waste in the Metal Trades Industry, Fred J. Miller. Management Eng., vol. 1, no. 3, Sept. 1921, pp. 135-140, 4 figs. Abstract of field report on elimination of waste in industry based on studies in sixteen representative plants.

Research, Benefit of. The Role of Research in Waste Elimination, Harrison E. Howe. Chem. & Metallurgical Eng., vol. 25, no. 9, Aug. 31, 1921, pp. 379-382. Encouragement of fundamental research in America said to be more urgently needed than stimulation of industrial research Fallacy of curtailing research and disrupting organization in times of industrial depression. Examples of waste eliminated by research.

WASTES

Industrial. Waste and Inefficiency in the Industries. Chem. & Metallurgical Eng., vol. 25, no. 9, Aug. 31, 1921, pp. 433-448. Series of short articles by industrial leaders featuring outstanding causes of waste in various industries. Frank confessions of inefficiency due to wide varity of causes.

WATER PIPES

Stresses in Horizontal. Stresses in Horizontal Pipes on Rigid Saddles. Theodore B. Parker. Eng. News-Rec., vol. 87, no 8, Aug. 25, 1921, pp. 306-309. 5 figs. Formulas and tables based on theroy of radical concentrated loads and fixity of shell at saddle support.

WATER POWER

Canada. Canada's Fuel and Water Power Problems. Engineer, vol. 132, no. 3418, July 1, 1921, pp 4-6, 4 figs. (Abstract.) Statements respecting relation of water power to Canada's fuel problems, published by Dominion Water Power Branch of Can. Dept. of Interior. Examples of waste eliminated by research.

Water Powers of the Prairie Provinces, C. H. Attwood. Jl. Eng. Inst. Can., vol. 4, no. 8, Aug. 1921, pp. 437-440. Resources, administration and market.

Geology and. Geology and the Hydroelectric Utilization of Water Falls (La Géologie et l'Aménagement Hydroélectrique des Chutes d'Eau), W. Kilian La Houille Blanche, vol. 20, no. 53-54, May-June 1921, pp. 81-90, 9 figs. Discusses cement work along the rivers. (Concluded.)

WATER SUPPLY

Birkenhead, England. Birkenhead's Alwen Water Supply. Engineer, vol. 132, no. 3425, Aug. 19, 1921., pp. 183-186, 14 figs. partly on. p. 194. Construction details of the Alwen River dam. Reservoir formed by dam has lenght of 3 mi. and average width of one-fifth of a mile; water area of 365 acres; volume of water impounded is over 3,000,000,000 gal. Daily supply of water will amount to 10,800,000 gal. Details of over flow sill, 42-mi. aqueduct lime-slaking tanks, etc.

New York City. The Development of the Sanitary Safeguards of the New York City Water Supply and its Relation to Typhoid Fever and Other Diseases, Frank E. Hale. Mun. Engrs. Jl.., vol. 7, 2nd quarterly issue, 1921, pp. 30-65, 8 figs. partly on supp. plates. Data covers improvement of water supply of Greater New York, particularly in last ten years.

Selection and Protection. Factors Governing the Selection and Protection of Sources of Water Supply, J. K. Hoskins. Contract Rec., vol. 35, no. 32, August 10, 1921, pp. 723-728. Discusses sources of supply, chemical and physical qualities, pollution, safeguards and costs.

WATER TREATMENT

Chlorination. Problems in the Chloriation of Water-I. Eng. News-Rec.; vol. 87, no. 10, Sept. 8, 1921, pp. 392-394. Experiences of seventeen water-works operators on effect of temperature on tastes and odors, corrosion of metals, and efficiency factors.

Types. Water Treatement- Intermittent or Continuous, W. R. Toppan. Ry. Age, vol. 71, no. 8, August 20, 1921, pp. 347-350, 5 figs. Discussion advantages and disadvantages of each system.

WATERWAYS

St. Lawrence River. Government Engineers Report on St. Lawrence Waterway, Eng. News-Rec., vol. 87, no. 10, Sept. 1, 1921, pp. 402-406.9 figs. on supp. plates. Engineering features of navigation and power development of river from Lake Ontario to Montreal, as reported to Int. Joint Commission by W. P. Wooten and W. A. Bowden.

WATERWORKS

Reservoirs vs. Additional pumps. Reservoirs vs. Additional Pumps for Peak Demands, L. A. Quayle. Eng. New-Rec., vol. 87, no. 8, Aug. 25, 1921, pp. 328-330, 7 figs. (Abstract.) Paper presented at Am. Water Works Assn.

WEIGHTS AND MEASURES

Accurate Equipment. The Essentials of Weighing in Industry, Herbert T. Wade. Management Eng., vol. 1, no. 3, Sept. 1921, pp. 129-134, 8 figs. Points out dependence of industry upon weighing, and advantages of good weighing practice and equipment. An example of routine weighing.

See Also Electric Welding; Electric welding, Arc; Electric Welding, Resistance.

WELFARE WORK

Co-operative Stores. Food as a Factor in Industrial Morale, John T. Bartlett. Indus. Management, vol. 62, no. 2, Aug. 1, 1921, pp. 83-88, 3 figs. It is claimed that the savings a co-operative store or farmers' market accomplish are equivalent to a wage increase.

Savings plans. Thrift Encouragement by Employers II and III, Leonhard Felix Fuld. Indus Management, vol.62, nos. 2 and 3, Aug. 1 and Sept. 1, 1921, pp. 93-94, and 139-140, Aug.: Discusses advantages of having employee authorize regular deductions from his pay, these deductions to be put into his savings account. Sept.: Bonus systems; savings and loan associations; the employer's position.

WIRE DRAWING

Dies for. Wire Drawing Dies With Connected Guides (Filières d'Etirage à Touches Rapportées), A. Catherine. L'Outillage, vol. 219, nos. 29 and 31, July 21 and Aug. 4, 1921, pp. 795-797, 12 figs. and 839-840, 8 figs. Describes improved methods of wire drawing and construction of guides.

WIRE ROPE

Care of. Instruction in the Care, Uses and Inspection of Flexible Steel Ropes, H. C. Boynton and W. Voigtlander. Jl. Engrs. Club of Phila., vol. 38-7 no. 199, July 1921, pp. 274-279. Discusses production and treatment of steel. manufacture of wire rope lubrication and inspection.

WOMEN WORKERS

New Avenues of Employment. The New Place of Women in Industry- VI, Ida M. Tarbell. Indus. Management, vol. 62, no. 2, Aug. 1, 1921 pp. 106-108. Discusses new professions which have opened for women as outgrowth of expanding interest in personnel work.

WOODWORKING PLANTS

Exhauster System. Exhauster System in Wood Working Plants-II, Sern Madsen. Wood-Worker, vol. 40, no. 6, August 1921, pp. 42-44, 30 figs. Discusses principles and details of hood construction for individual machines.

Engineering Index

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A

ABRASIVE WHEELS

Selection and Grading. Griding Wheels, James Shaddock and Alfred Herbert. Eng. Production, vol. 3, no. 48, Sept. 1, 1921, pp. 198-200, 2 figs. Notes on selection and grading. Gives list of wheels suitable for use on Norton machines for external grinding, and on Heald machines for internal grinding.

ACCOUNTING

Power Plants. Power-Plant Accounts—I, II, III, IV and V, Wilfred E. Miller. Power, vol. 54, nos. 11, 12, 13, 14 and 15, Sept, 13 20, 27, Oct. 4 and 11, 1921, pp. 408-410, 448-451, 489-491, 528-530 and 558-560, 13 figs., Sept. 13: Tells what accounting is and shows how to keep records of labour, fuel, water, lubricants, ash removal, repairs, scale removal, etc. Sept. 20 and 27: Use of journal and ledger. Oct. 4 and 11: Indirect expense.

AERONAUTICS

Technical Problems. Some Technical Problems in Aeronautics. Mech. Eng., vol. 43, no. 8, Aug. 1921, pp. 526-528 and 562, 8 figs. Aluminum cylinder castings, air-cooled airplane engines, airplane carburetors and radiators, aerial photography, machine-gun synchronizers, etc., as discussed at joint visit of Am. Soc. Mech. Engrs. and Soc. Automotive Engrs. to McCook Field.

AEROPLANE ENGINES

Comparative Data. Comparative. Aircraft Engine Data. Automotive Industries, vol. 45, no. 10, Sept. 8, 1921, p. 457. Gives figures as to power of engines compression ratio, fuel consumption, mean effective pressures, weight per hp. working stresses, etc. From La Technique Moderne.

Types. Aero Engines, Alan E. L. Chorlton. Jl. Roy. Soc. Arts, vol. 69, no. 3589, Sept. 2, 1921, pp. 689-705, 17 figs. Discusses various types of engines and gives tables of test data of leading engines in 1914, both British war office trials and German aeroplanes engine trials.

AEROPLANES

Balancing. The Design of Aeroplane Control Surfaces, with Special Reference to Balancing, H. B Irving. Aeronautical Jl., vol. 25, no. 130, Oct. 1921, pp. 537-555, 13 figs. Discusses three methods of balancing, all of which have been used in varying measure in practice: The "horn" method. "backward hinge" method; and Avro patents method.

Helicopters. *See Helicopters*

Safety Factors in Design. Safety Factors in Airplane Design, Alfred S. Niles. Eng. News-Rec., vol. 87, no. 12, Sept. 22, 1921, pp. 490-491. Reasons for adoption of low factors based on abnormal conditions. Successful use of long columns.

Struts. Non-Injurious Ultimate-Strength Tests for Interplane Struts, E. R. Maurer. Jl. Soc. Automotive Engrs., vol. 9, no. 3, Sept. 1921, pp. 201-207, 10 figs. Describes direct test by subjecting the strut to ordinary test for maximum load, and indirect test, consisting in making a simple bending-test for certain data.

ALCOHOL

Fuel. Alcohol as a Combustion Fuel, E. C. Freeland and W. G. Harry. Sugar, vol. 23, no. 9, Sept. 1921, pp. 474-476. Concluded that alcohol is destined to supplant gasoline. (Continuation of serial)

Molasses as Source. Use of Alcohol Made From Final Molasses As Motor Power in Cuba, R. G. Tillery. La. Planter & Sugar Manufacturer, vol. 67, no. 9, August 27, 1921, pp. 132-143.

ALIGNMENT CHARTS

Principles and Uses. The Alignment Chart, C. W. Crockett. Automotive Industries, vol. 45, no. 13, Sept. 29, 1921, pp. 614-618, 5 figs. Exposition of principles underlying construction of alignment charts. Used for graphical representation of many mathematical relations.

ALLOY STEEL

Heat Treatment. Three Types of Allow Sheet Steel—II and III. Horace C. Knerr. Iron Age, vol. 108, nos. 11 and 12, Sept. 15 and 22, 1921, pp. 655-658 and 725-728, 7 figs. Sept. 15: Details of heat treatment necessary to attain highest tensile strength: hardness and other data. Sept. 22: Electric and acetylene welding details and their effect on physical properties; chrome-vanadium steel adopted.

ALLOYS

Physical Properties. Thermal, Electrical and Magnetic Properties of Alloys, Alpheus W. Smith. Jl. Franklin Inst., vol. 192, nos. 1 and 2, July and August 1921, pp. 69-105 and 157-202, 57 figs. Deals with metals insoluble in each other completely soluble in each other, with limited solubility in each other, and forming compounds with each other. Notes on change of thermoelectromotive force with temperature; theories of resistance and thermoelectric forces, and resistance and hardness.

White-Metal Bearings. White Metal Bearings Alloys, John R. Freeman, Jr. and B. W. Woodward. Metal Ind., vol. 19 no. 9, August 26, 1921. pp. 149-152, 3 figs. Discusses design of new apparatus and results of tests to determine mechanical properties in compression and Brinell hardness at elevated temperatures. Technologic paper Bur. Standards, No. 188.

See also Aluminum Alloys Bearing Metals: Brass: Bronzes: Copper Alloys: Magnesium Alloys: Nickel Alloys: Zinc Alloys.

ALUMINUM

Castings. Aluminum Casting, F. A. Livermore. Brass Wld., vol. 17, no. 8, August 1921, pp. 231-233. Discusses hardness and composition of alloys, also welding aluminum.

Uses. Aluminum and Its Uses (L'aluminium et ses applications), Sigma. La Metallurgie, vol. 53, nos. 35 and 36, Sept. 1 and 8, 1921, pp. 1663-1664 and 1701-1702. Discusses its properties and application in aeronautics. (Concluded.)

ALUMINUM ALLOYS

Aluminum Copper. Aluminum-Copper Alloys' Robert J. Anderson. Am. Electrochemical Soc. advance paper no. 16, for Meeting Sept. 29-Oct. 1, 1921, pp. 207-236, 1 fig. General information with regard to manufacture, properties, and uses of commerical aluminum-copper alloys employed in United States. Bibliography.

Aluminum-Magnesium-Silicon. The Constitution and Age-Hardening of the Alloys of Aluminum with Magnesium and Silicon. D. Hanson and Marie L. V. Gayler. Inst. Metals advance paper for meeting Sept. 21-22, 1921, no. 35 pp. 47 figs. Results of investigation, summarized in diagrams are said to leave little doubt that ageing of these alloys is due to face that, on quenching, magnesium and silicon are retained, probably in solution, in an unstable condition from which they tend to revert to a more stable form.

Iron-Pot Melting. Iron-Pot Melting Practice for Aluminum Alloys—IV, Robert J. Anderson. Metal Ind. (N.Y.), vol. 19, no. 9, Sept. 1921, pp. 360-362, 2 figs. Discusses size and capacity of furnaces, furnace linings and their life. (To be continued.)

Production. Experiments in the Production of Alloys for Aluminum Sheets, W. Schulte. Metal Ind. (Lond.), vol. 19, no. 8, August 19, 1921, pp. 131-134. Gives physical properties of a large number of alloys of different composition. Translated from Die Metallbörse.

ASBESTOS

Black Lake Area. The Black Lake Asbestos Area, Wyant D. Hubbard. Eng. and Min. Jl., vol. 112, no. 10, Sept. 3, 1921, pp. 365-368, 6 figs. District rich in chrysotile asbestos deposited in Serpentine. Open-pit mining using derricks and cables is usual practice.

AUTOMOBILE ENGINES

Machining. Machining Motor-car Engine Fly-wheels. Machinery (Lond.), vol. 18, no. 465, August 25, 1921, pp. 641-645, 13 figs. Use of vertical automatic lathes for finishing all surfaces at two settings of work.

Pistons. Manufacturing Automobile Pistons in a Jobbing Shop, Robert Mawson. Am. Mach., vol. 55, no. 13, Sept. 29, 1921, pp. 492-496, 11 figs. Manufacturing on small scale made possible in job shop by use mple tools and fixtures.

AUTOMOBILE FUELS

Alcohol. Production of 95-97 per cent Alcohol for Motor Fuel. Int Sugar Jl., vol. 23, no. 273, Sept. 1921, pp. 513-516, 1 fig. Describes improved triple column continuous still made by Blair, Campbell & McLean of Glasgow for production of Natilite.

See also Alcohol.

Producer Gas. Producer Gas as a Fuel for Automotive Vehicles, P. M. Heldt. Automotive Industries, vol. 45, nos. 10 and 11, Sept. 8 and 15, 1921, pp. 461-464 and 507-511, 7 figs. Discusses theoretical and practical aspect of possibility of operating truck or similar internal-combustion engines on gas derived directly from coal. Describes three British systems and their method of operation.

See also Gasoline.

AUTOMOBILES

Interaction of Wheels, Springs and Roads. Holding The Road, J. L. Napier. Automobile Engr., vol. II, no 153, August 1921, pp. 266-272, 12 figs. Discussion of fundamental principles affecting interaction of wheels, springs and roads.

Machining Methods. Special Fixtures in the Peerless Shop. Am Mach., vol. 55, no. 14, Oct. 6, 1921, pp. 549-550, 7 figs. Milling fixtures for continuous work; fixture for grinding ball ends; radius milling and threading; drilling connecting rods.

Rear-Axle Casing. Machining Rear Axle Casings. Machinery (Lond.), vol. 18, no. 470, Sept. 29, 1921, pp. 781-786, 11 figs. Discusses methods of machining a malleable iron casting for motor rear-axle casing. Production costs.

Rear-Axle Housing. Machining Two Peerless Rear-Axle Parts, Fred. H. Colvin. Am. Mach., vol. 55, no. 13, Sept. 29, 1921, pp. 510-512, 9 figs. Notes on machining and assembly of rear-axle housing; fixtures used in production brake spider.

Repairing Methods and Equipment. Automotive Service methods and Eqjuipment, Howard Campbell. Am. Mach., vol. 55, no. 16, Oct. 20, 1921, pp. 619-623, 11 figs. Tools and methods used at New York Packard service plant, including testing fixtures, special reamers and other tools. "Maximum estimate" system.

Shop Practice, Daimler. The Works of the Daimler Co., Ltd. Automobile Engr., vol. 11, no. 153, August 1921, pp. 285-290, 20 figs. Interesting examples of shop practice on special work, at Coventry, Eng.

Suspensions. Acme Spring Suspension. Autocar, vol. 47, no. 1350, Sept. 3, 1921, pp. 427-428, 4 figs. Describes three cantilever spring system for insulation from rough shocks.

Suspensions for Automobiles (Le problème de la suspension des voitures automobiles), M. Broulhiet. Revue de l'Industrie Minérale, no 17, Sept. 1, 1921, pp. 93-100, 7 figs. It is shown that perfection can be attained in this as well as in other parts of automobile. (Concluded.)

Wheels. The Production of Pressed Steel Wheels Is Successfully Accomplished, J. Edward Schipper. Automotive Industries, vol. 45, no. 14, Oct. 6., 1921, pp. 668-671, 9 figs. Describes the various operations required in fabricating Gier pressed steel disk wheel.

See also Carburetors.

AVIATION

Civil. Developing a Ground Organization for Civil Aviation—II, W. F. Bradley. Automotive Industries, vol. 45, no. 13, Sept. 29 1921, pp. 622-626, 6 figs. Discusses commercial aviation in France based on system of government subsidies. Particulars of air traffic; diagrams of 1st, 2nd, 3rd and 4th class landing fields. (Concluded.)

B

BALANCING

Unbalance, Static and Dynamic. Four Years of Balancing Practice, N. W. Akimoff. Shipbldg. and Shipg. Rec., vol. 18, no. 10, Sept. 8, 1921, pp. 311-314, 6 figs. Discusses static unbalance, dynamic unbalance, obstacles in the development of the art, etc. (From Jl. Am. Soc. Naval Engrs.)

BEARINGS METALS

Bronze. Bronze for Bearing Metal, E. T. Keenan. Power, vol. 54, no. 9, Aug. 30, 1921, pp. 322-323. States that satisfactory results for general use was obtained with alloy consisting of copper 75 per cent, lead 17 per cent, zinc 5 per cent, tin 3 per cent.

BEARINGS, BALL

Manufacture. Ball and Roller Bearing Manufacture—I, J. D. Scaife. Eng. Production, vol. 3, no. 52, 53 and 54, Sept. 29, Oct. 6 and 13, 1921, pp. 290-293, 314-319 and 340-343, 25 figs. Methods employed. Paper presented before Instn. Production Engrs. Oct. 13: Discussion.

The Ball Bearing: In the making Under Test, and on Service, Henry L. Heathcote. Mech. Wld., vol. 70, nos. 1808 and 1811, Aug. 26 and Sept. 16, 1921, pp. 159-161, 3 figs and 220-222, 3 figs. (Continuation of serial). Paper read before Instn. Automobile Engrs.

BEARINGS ENGINE

Machine for Fitting. Lapping and Running-in Machine. Machinery (Lond.), vol. 18, no. 470, Sept. 29, 1921, pp. 791-793, 4 figs. Discusses running-in and lapping processes in connection with fitting automobile engine bearings.

BELTING

Quarter-Twist. On an Irregular Behavior of Ordinary Quarter Twist Belt and Its Prevention, Hosaku, Iwaoka. Jl. Soc. Mech. Engrs. and Soc. Nav. Architects, Sept. 1921, (In Japanese.)

BLAST FURNACES

Crane Operation. Crane operating Costs at Blast Furnaces, George L. Collord. Iron Age, vol. 108, no. 15, Oct. 13, 1921, pp. 935-936, 1 fig. Locomotive and ore-bridge cranes shown to save much money, compared with hand methods formerly used. Analysis of costs.

Zinc. A Blast Furnace for Zinc, Evans W. Buskett. Eng. and Min. Jl., vol. 112, no. 11, Sept. 10, 1921, pp. 409-410. Experiments in smelting of ores under pressure suggested which might result in economies over present methods.

BOILER FEEDWATER

Grease in. Grease in Boiler Feed Water, Edward Ingham. Colliery Guardian, vol. 122, no. 3163, August 12, 1921, pp. 447-448. Explains how grease gets into boiler, its deleterious effect, and how to remove grease.

Softening. Boiler Feed Water Purification —II. Eng. and Indus. Management, vol. 6, no. 9, Sept. 1, 1921, pp. 230-231. Outlines respective merits of various methods used for boiler-feed water treatment, with special reference to advantage of the Zeolite water-softening process.

Treatment. Boiler Feed Water Treatment and Treatment Control, E. G. Bashore. Combustion, vol. 5, no. 4, Oct. 1921, pp. 163-166. Discusses boiler compounds, feedwater heaters, continuous tank systems, intermittent tank system, zeolite, and internal treatment. (Abstract). Paper read before Chem. Exposition.

Boiler Water Treatment Plants, Robert June. Blast Furnace and Steel Plant, vol. 9, no. 9, Sept. 1921, pp. 564-566. Formulates specifications for ideal water-purification plants.

Water Treatment for Boilers, Julian S. Simsohn. Mech. Eng., vol. 43, no. 9, Sept. 1921, pp. 597-600 and 606, 2 figs. Various methods of water softening. Treatment of excessive concentration of soluble salts in boiler. Corrosion of boilers and economizers due to decomposition of organic compounds at high temperatures accompanying present steam pressures and superheats, etc.

BOILER OPERATION

Control. The Control of Boiler Operation, Walter N. Flanagan. Assn. Iron and Steel Elec. Engrs., vol. 3, no. 9, Sept. 1921, pp. 453-469, 5 figs. Discusses hand and automatic control, a.c. and d.c. drive for auxiliaries.

Efficiency as Affected by Draft. Boiler Efficiency and Output as affected by Draught, Alexander R. Horne. Engineer, vol. 142, no. 3430, Sept. 23, 1921, pp. 322-323, 3 figs. Investigates relations between efficiency, evaporative power and stokehold air pressure in steam boiler, in light of results of series of twelve exhaustive tests carried out by five authorities upon a marine boiler of Inglis type.

Efficient. Successful Boiler Operation, Guy L. Warden. Combustion, vol. 5, no. 3, Sept. 1921, pp. 116-117. Discusses type of equipment, its arrangement for operation, operators and their instructions, accessories and instruments.

Industrial. The Practical Operation of Industrial Boilers, W. E. Snyder. Mech. World, vol. 70, no. 1811; Sept. 16, 1921, pp. 231-232. Discusses instruments in boiler room and their proper use, training of operators, etc. (Continued.)

BOILER PLANTS

Equipment. Modern Boiler House Arrangement and Equipment, R. M. Gordon. Combustion, vol. 5, no. 4, Oct. 1921, pp. 159-161, 8 figs. Describes boiler plant of Solvay Process Co., an outgrowth of several smaller plants. (Abstract.) Paper read before Chem. Exposition.

BOILERS

Electrically Heated. Electrically Heated Steam Boilers, Eric A. Lof. Power Plant Eng., vol. 25, no. 18, Sept. 15, 1921, pp. 919-920, 3 figs. Electric boiler problem in general does not offer any technical difficulties; used where power is very cheap.

Hand-Fired. Hand-Fired-Boiler Performance in France, Caroll F. Merriam. Power, vol. 54, no. 13, Sept. 27, 1921, pp. 473-474. Contains abstract of report of First Subcommittee of Commission for Utilisation of Fuels, published in Revue Générale de l'Electricité; and comparison of American and French boiler performances.

Steam Heating. Largest Boiler to Supply Steam for Heating, J. H. Walker. Power, vol. 54, no. 13, Sept. 27, 1921, pp. 477-478, 2 figs. Details of saturated-steam boiler unit having 29,820 sq. ft. of steam-making surface, being installed in heating plant of Detroit Edison Co. Volume of combustion chamber, 11,440 cu. ft. Two 14-retort motor driven underfeed stokers have fuel-burning capacity of 33,600 to 39,200 lb. of coal per hour.

BOILERS, WATER-TUBE

New Designs. The Three New Designs of Water Tube Boilers, Tsuruzo Matsumura. Jl. Soc. Mech. Engrs. and Soc. Nav. Architects, Sept. 1921, (In Japanese.)

BRAKES

Automatic Air. Physical and Operating Conditions on the Denver and Salt-Lake Railroad. Ry. and Locomotive Eng., vol. 34, no. 9, Sept. 1921, pp. 233-238, 8 figs. The traffic hauled and results of a recent demonstration of the automatic straight air brake.

Engine-Testing. Air-brakes for Engine Testing, Etc., A. T. Ross. Mech. Wld., vol. 70, no. 1808, August 26, 1921, pp. 168-169, 5 figs. Describes a cheap and simple method of constructing an absorption brake for determining the b.hp. of any size engine.

BRASS

Pickling of Strip. Continuous Pickling of Strip Brass, Wadsworth Doster. Metal Ind. (Lond.), vol. 19, no. 8, August 19, 1921, pp. 137-138, 4 figs. Describes the automatic strip cleaning machine used in brass rolling mills.

Tempering with Tin Content. Tempering Brasses With a Tin Content (La Trempe des laitons à l'étain), Leon Guillet. Revue de Métallurgie, vol. 18, no. 7, July 1921, pp. 445-458, 26 figs. Concludes that one per cent of tin does not have the bad effect on mechanical properties generally attributed to it.

BRASS FOUNDING

Casting of Ingots. The Casting of Brass Ingots, R. Genders. Inst. Metals advance paper for meeting Sept. 21-22, 1921, no. 3, 4 pp. 2 figs; also Engineering vol. 112, no. 2908, Sept. 23, 1921, p. 452, 2 figs. Results of experiments carried out to minimize occurrence of non-metallic inclusions. Describes method involving use of short broad tapered ingots with dozzle feed, by use of which, it is claimed, failures and wastage were considerably reduced.

England. Modern Developments in the British Brass Industry, Ernest A. Smith. Am. Electrochemical Soc. advance paper, no. 24, for Meeting, Sept. 29-Oct. 1, 1921, pp. 301-326. Discusses electric brass furnaces in England; extrusion, hot pressing and forging of brass; rolling-mill practice; annealing; composition of industrial brasses; and treatment and utilization of scrap brass.

BRIDGES, HIGHWAY

Concrete Arch. Concrete Arch Bridge of Three 250-Foot Spans, E. H. Harder. Eng. News-Rec., vol. 87, no. 12, Sept. 22, 1921, pp. 472-476, 7 figs. Long spand of high-level bridge over Monogahela River at Fairmont, W. Va., controlled by required channel clearance. Special architectural treatment. Three spans centered simultaneously.

BRIDGES, LIFT

Comparison With Other Types. Lift Bridges Compared with other Movable Forms, J. A. L. Waddell. Jl. Assn. Chinese and Am. Engrs., vol. 2, no. 6, June 1921, pp. 27-33, 1 fig. Analysis of their relative advantages and detailed study of vertical moving types.

BRIDGES RAILWAY

Live Loads on. Suggested Method of Representing Live Loads on Bridges, Henry E. Stratton. Ry. Engr., vol. 42, no. 500, Sept. 1921, pp. 349-351, 8 figs. Describes simple form of expression for any system of live loads which facilitates computations.

BRONZES

Low-Tin. The Effect of Progressive Colf-Drawing upon Some of the Physical Properties of Low-Tin Bronze, W. E. Alkins and W. Cartwright. Inst. Metals advance paper for meeting Sept. 21-22, 1921, no. 6, 23, pp., 17 figs. Experimental data is summarized in diagrams showing variation during cold-drawing of the three properties, tensile strength, specific volumem, and scleroscope hardness.

Manganese. Casting Manganese Bronze Test Bars, E. H. Dix, Jr. Foundry, vol. 49, no. 18, Sept. 15, 1921, pp. 734-736, 1 fig. Discusses several methods of casting and compares results of physical tests.

C

CAR WHEELS

Molding. Molds Car Wheels on Jolt Machines. Foundry, vol. 49, no. 18, Sept. 15, 1921, pp. 709-713, 11 figs. Made possible by adaptation of conveyor systems for transferring molds, flasks and sand.

Tires. British Standard Specification for Tramway Tyres. British Eng. Standards Assn., no. 101, July 1921, 11 pp. 7 figs. Includes conversion table from tons to pounds, appendix giving forms of British standard tensile test pieces; and diagram illustrating British standard tires for tramway driving and pony wheels.

CARS

Frames. A Study of Carriage Frames (Etude des Châssis de Wagons), M. Le Touzé. Revue Générale des Chemins de Fer, vol. 40, no. 9, Sept. 1921, pp. 185-205, 11 figs. Calculates stresses in car or carriage frames when over 10-12 m. long and describes successful method of construction by Compagnie de l'Est.

CAR LIGHTING

Electrical Equipment. Principles of Car Lighting By Electricity—XIV, Charles W. T. Stuart. Ry. Elec. Engr., vol. 12, no. 9, Sept. 1921, pp. 345-353, 18 figs. Describes E.S.B. car lighting equipment consisting of a generator, generator regulator panel and a storage battery which is suspended in a box under car body.

CARS, COAL

Chesapeake and Ohio R. R. 100-Ton Coal Cars for the Chesapeake and Ohio. Ry. Age, vol. 71, no. 13, Sept. 24, 1921, pp. 567-570, 6 figs. High capacity cars adopted for handling export coal. Drop doors provided for emergency unloading.

CARS, PASSENGER

Insulation-of. Insulation of Passenger and Refrigerator Cars, Arthur J. Wood. Ry. Mech. Engr., vol. 95, no. 9, Sept. 1921, pp. 547-549. Discussion of principles involved in determining heat transmission under various conditions.

Sleepers. New Sleeping Car, Canadian National Railways. Can. Ry. and Mar. Wld., no. 282, Sept. 1921, pp. 465-466, 3 figs. Built by Canadian Car & Foundry Co.

CARS, REFRIGERATOR

Temperature Control. Controlling Refrigerator Car Temperature in Winter Months. Ry. Rev., vol. 69, no. 10, Sept. 3, 1921, pp. 293-297, 9 figs. Department of Agriculture makes practical suggestions for reducing loss and damage to fruit shipped in refrigerator cars during winter months.

CASTINGS

Centrifugal. Centrifugally Cast Products. Can. Engr., vol. 41, no. 9, Sept. 1, 1921, pp. 1 and 5. Summary of recent descriptions of centrifugal casting processes.

Specification and Testing. The Specification and Testing of Castings, Walter Rosenhain. Automotive Industries, vol. 45, no. 5, August 4, 1921, pp. 217-219. Analyzes various methods and indicates best practice under present conditions.

CEMENT

New French Product. Quick Hardening Cement Developed by the French, Edwin C. Eckel. Eng. News-Rec., vol. 87, no. 14, Oct. 6, 1921, pp. 566-567. Discusses characteristics of new fused product of high alumina content which, it is claimed should prove of value in many kinds of construction.

CHAIN DRIVE

Roller Chain. The Development of the Roller Chain Drive, G. M. Bartlett. Automotive Industries, vol. 45, no. 8, August 25, 1921, pp. 363-366, 6 figs. Discusses changes in design and construction of chain and sprockets and a new form of roller-chain sproket tooth. From paper presented at meeting of Gear Manufacturers' Assn.

CHROME-NICKEL STEEL

Heat Treatment and Characteristics. Nickel-chromium Steels: Their Heat-Treatment and Characteristics. W. E. Murphy. Machinery (Lond.), vol. 18, no. 465, August 25, 1921, pp. 638-639, 2 figs. Gives mechanical properties; shows effect after oil-hardening and air-hardening.

CHUCKS

Magnetic. Magnetic Chucks Require Careful Mounting. F. Horner. Can. Machy., vol. 26, no. 9, Sept. 1, 1921, pp. 33-35, 7 figs. Mounting can be of permanent or temporary character; magnetic holding faces of chuck must be absolutely correct.

CITY PLANNING

Progress in United States. Progress in City Planning in the United States, Jacob L. Crane Eng. News-Rec., vol. 87, no. 13, Sept. 29, 1921, pp. 526-528. Presents data showing progress and tendencies in art of city planning.

COAL

Trent Cleaning Process. Coal Cleaning. Times. Eng. Supp., no. 563, Sept. 1921, p. 253. Discusses development of Trent process.

COAL BREAKERS

Anthracite. Advances in the Preparation of Anthracite, Dever C. Ashmead. Trans. Am. Inst. Min. and Metallurgical Engrs., no. 1099-C, Sept. 1921, 85 pp., 58 figs. Developments in preparation of coal. Discusses use of rolls, shaker screens, feeders, chutes, air washers, Conklin separator, jigs; the chance sand flotation process, concentrating tables etc. Describes leading anthracite breakers and gives tables showing results of tests at various breakers.

COAL HANDLING

Locomotive Cranes. Economical Coal Handling With Locomotive Cranes, H. D. Fisher. Combustion, vol. 5, no. 3, Sept. 1921, pp. 108-110, 4 figs.

COAL INDUSTRY

Canada. Canada's Coal Problem, C. V. Corless. Monthly Bul. Can. Inst. Min. and Met., no. 113, Sept. 1921, pp. 781-791. Discusses engineering elements, railway policy, Eastern and Western Coal; advises to tackle the difficulties courageously.

Western Canada. The Situation of Western Canada. Jl. Eng. Inst. Can., vol. 4, no. 9, Sept. 1921, pp. 496-500. Discusses thermal value of coal, distribution by-product oven practice.

COFFERDAMS

Types. Crib and Cofferdam Work—II and III, Pub. Works, vol. 51, nos. 14 and 15, Oct. 1 and 8, 1921, pp. 255-257 and 281-283, 6 figs. Oct. 1: Telescopic steel sheet pile cofferdam; design and method of installation of interior bracing; floating, sectional and detachable, anchoring and sealing crib cofferdams.Oct. 8: Pneumatic caisson cofferdams for dams and excavations in quicksand; unwatering cofferdams by pumping and draining.

COKE OVENS

By-Product. The Coke Industry and the By-product Oven. Chem. Age. (N. Y.), vol. 29, no. 8, August 1921, pp. 327-329. Discusses petroleum, gas, beehive and by-product coke and gives list of American by-product coke-oven installations.

COLD STORAGE

Mechanical Handling of Meats and Produce. The mechanical Handling of Meat and Produce in Cold Storage, S. G. Calladine. Cold Storage and Ice Assn. Proc., vol. 17, no. 2, 1921, pp 43-50 and (discussion) 51-58, 6 figs. on supp. plates. Discusses existing methods and various types of conveyors used, comparative cost, etc.

Piping for Rooms. Piping required in Cold Storage Rooms, Benj. J. Masters. Southern Engr., vol. 36, no. 1, Sept. 1921, pp. 38-41. Calculates piping for various conditions.

CONCRETE

Alkali Soils, in. Concrete in Alkali Soils. Jl. Eng. Inst. Can., vol. 4, no. 9, Sept. 1921, pp. 489-494. Report of Calgary and Manitoba Committees on deterioration of concrete in alkali soils.

Deterioration by Sewer Gas. Life of Concrete When Used As Carrier of Domestic Sewage, A. C. Shaver. Sanitary and Heating Eng., vol. 96, no. 7, Sept. 23, 1921, pp. 189-192, 8 figs. Committee report of Am. Soc. of Sanitary Engrs, showing deterioration of concrete as effected by sewer gas and alkalies.

CONCRETE CONSTRUCTION

Hollow-Wall System. McLeod System of Hollow Wall and Floor Units. Concrete, vol. 19, no. 3, Sept. 1921, pp. 106-107, 7 figs. System of concrete wall construction developed in New Zealand consists in erecting a cavity wall of precast block without mortar, and filling interior of block with slush concrete, giving, in effect, a monolithic wall, double or single, without disadvantage of form work.

CONCRETE. REINFORCED

Specifications. Discussion on Tentative Specifications for Concrete and Reinforced Concrete, W. A. Slater. Proc. Am. Soc. Civ. Engrs., vol. 47, no. 7, Sept. 1921, pp. 243-250, 2 figs. Submitted as progress report of Joint Committee on Standard Specifications for Concrete and Reinforced Concrete.

CONCRETING

Plant for Dam Construction. Handling Plant for the Construction of the Eel. River Dam. Eng. and Indus. Management, vol. 6, no. 10, Sept. 8, 1921, pp. 281-283, 1 fig. As far as possible all handling methods for raw materials and for mixed concrete were performed mechanically or by gravity. Details of contractor's plant, including screw conveyors for delivering cement horizontally, and zig-zag concrete shoots, for delivering vertically.

CONDENSERS, STEAM

Air Pumps for. Recent Improvements in Condensing Apparatus for Steam Engines (Récents perfectionnements des appareils de condensation des machines à vapeur d'eau), L. Jauch. Chaleur et Industrie, vol. 2, no. 16, August 1921, pp. 501-508, 13 figs. Discusses air pumps of various types. (Continuation of serial.)

Surface. Surface Condenser Operation, George C. Cook. Power, vol. 54, no. 10, Sept. 6, 1921, pp. 365-367. Notes on vacuum decrease with temperature increase; quantity of circulating water required; air and steam distribution; removing deposits from inside surfaces; and other methods of cleaning.

Surface and Jet. Modern Surface and Jet Condensers, K. Hoefer. Eng. Progress, vol. 1, nos. 7-8, July-August 1920, pp. 237-242, 14 figs. Describes various types, cleaning during running.

Tests of Various Types. Relative Efficiency of Various Types of Condensing Apparatus, Allen F. Brewer and Frank A. Stivers. Mech. Eng., vol. 43, no. 10, Oct. 1921, pp. 672-673. Results of comparative tests carried out on double-pipe coils, submerged coils with and without manifolds, and cooling towers, and of value as guide in selection and design of most efficient type of condenser.

Water-Distributing Device. New Water Distributing Device For Condensers, George M. Kleucker. Ice and Refrigeration, vol. 61, no. 2, August 1921, p. 84, 1 fig. Discusses U. S. Patent 1, 291,026

CONNECTING RODS

Machining. Machining Connecting Rods. Machinery (Lond.), vol. 18, no. 369, Sept. 22, 1921, pp. 759-763, 13 figs. Manufacturing methods employed by Austin Motor Co., Longbridge Works, Birmingham, for producing balanced connecting rods.

COPPER ALLOYS

Copper Zinc. The Density of the Copper-Zinc Alloys, T. C. Bamford. Inst. Metals advance paper for meeting Sept. 21-22, 1921, no. 4. 12 pp. 4 figs. Results of investigation of both chill and sand-cast billets show that with only one exception the densities of sand-cast specimens are less than those of chill-cast ones.

COST ACCOUNTING

Mechanical. Cost Accounting by Machinery E. W. Workman. Eng. and Indus. Management, vol. 6, no. 12, Sept. 22, 1921, pp. 314-318, 4 figs. Describes Hollerith systems of mechanical sorting and tabulating, application of these systems to problems of collecting labor and overhead expenses, and applying them to costs of manufactured articles etc.

Methods. The Necessity of Proper Cost Accounting. J. B. Sehl. Forging and Heat Treating, vol. 7, no. 8, August 1921, pp. 432-434. Methods of distributing expense over product are, the percentage, man hour, sold hour, list percentage and machine rate or production center methods.

Overhead, Allocation of. The Correct Allocation of On-Costs, H. Varley. Eng. and Indus. Management, vol. 6, no. 9, Sept. 1, 1921, pp. 241-242. Where reductions can be made.

Uniform System. Uniform Cost System Use Advised , Robert E. Belt. Iron Trade Rev., vol. 69, no. 13, Sept. 29, 1921, pp. 807-809. Points out benefits to be derived by introduction of such a system; too much detail has proved detrimental. States that accountant should be familiar with manufacturing methods.

CRANES

Harbour. Modern Harbour Cranes Richard Hänchen. Eng. Progress, vol. 1, no. 6, June 1920, pp. 203-210, 10 figs. Describes slewing, travelling, gantry, and double cranes.

Operator's Manual. Crane Operator's Manual, L. F. Galbraith. Assn. Iron and Steel Elec. Engrs., vol. 3, no. 9 Sept. 1921, pp. 437-452, 12 figs. Duties o crane operators, including inspection, reports, operations, etc. (Report o Educational Committee for 1921.)

CUTTING TOOLS

Selection and Use. Selection and Proper Use of Cutting Tools. Can. Machy., vol. 26, no. 9, Sept. 1, 1921, pp. 36-40, 15 figs. Discusses design, use in operation, maintenance, etc.

CYLINDERS

Steel, Tests of. Experiments on the Effects of Extremely High Pressure, P. W. Bridgman. Compressed Air Mag., vol. 26, no. 9, Sept. 1921, pp. 10223-10225, 4 figs. Describes experimental tests of tool steel and mild steel cylinders, the former rupturing at 40,000 atmospheres.

D

DIE CASTINGS

Advantages. Die Castings— I and II, A. G. Hopking. Engineer, vol. 132, nos. 3429 and 3430, Sept. 16 and 23, 1921, pp. 281-282 and 309-311, 5 figs. Description and advantages of die-casting process, and some of its uses.

DIES

Die-Sinking Machines. Die Sinking and Metal Patternmaking by Automatic Machine, Joseph F. Keller. Mech. Eng., vol. 34, no. 9, Sept. 1921, pp. 584-588 and 606, 16 figs. Discusses dies used for stamping, forging, embossing, pressing, etc. Notes on various methods employed in die sinking; automatic die-sinking machines; duplicating machines; advantages and relative cost of machine-cut dies

Die-Sinking Machine. Engineering, vol. 112, no. 2905, Sept. 2, 1921, pp. 341-342, 4 figs. Constructed by Bryant Symons & Co., London, for cutting dies used in drop-forging work.

Electrical Terminals and Connectors. Dies for Electrical Terminals and Connectors. Machinery (Lond.), vol. 18, no. 468, Sept. 15, 1921, pp. 743-750, 10 figs. Discusses piercing, trimming and forming dies, and dies for making band clamp ends.

Self-Opening Die Heads. Self-Opening Die Heads. Eng. Production, vol. 3, nos. 51 and 52, Sept. 22 and 29, 1921, pp. 269-274 and 296-300, 35 figs. Design, construction and application.

DIESEL ENGINES

Construction and Lubrication. Diesel Engine Practice. L. A. H. Pritchard. Power Plant Eng., vol. 25, no. 18, Sept. 15, 1921, pp. 901-903, 4 figs. Discusses Diesel oil engine construction and lubrication.

Ignition. Internal Combustion Engines, Charles E. Lucke. Power, vol. 54, no. 13, Sept. 27, 1921, pp. 479-483, 18 figs. Ignition problems in semi-Diesel and Diesel oil engines.

Improvements. Innovations in Diesel Engine Construction. Mar. Eng., vol. 26, no. 9, Sept. 1921, pp. 700-701, 1 fig. German builders introducing novelties in Burmeister and Wain design; Blohm and Voss building new double acting engine.

Knocks. Knocks in Diesel Engines, Louis R. Ford. Power, vol. 54, no. 9, Aug. 30, 1921, pp. 327-328. Deals with worn bearing knocks, knocks in valve gear, and within cylinder. Characteristics and causes.

Marine. Diesel and Semi-Diesel Marine Engines— Renault System (Les moteurs Diesel et Semi-Diesel Marine—système Renault); Ch. Dantin. Le Génie Civil, vol. 79, No. 11, Sept. 10, 1921, pp. 221-225, 10 figs. Discusses large increase in heavy-oil engines; describes Renault 300-hp. Diesel and 80-hp. semi-Diesel.

Marine Diesel Engine Operation (La conduite des moteurs Diesel marins), Y. Le Gallou. Bulletin Technique du Bureau Veritas, vol. 3, no. 7, July 1921, pp. 160-163. Studies causes of bad functioning, including air compressors and their influence, lubricating, etc. (Concluded.)

Overhauling. Overhauling an Oil Engine, G. Grow. Power, vol. 54, no. 10, Sept. 6, 1921, pp. 375-377. 7 figs. Author's experience in overhauling a Diesel engine.

DRAINAGE

Tile. Suggestions on the Design of Tile Drainage Systems, J. W. Dappert. Mun. and County Eng., vol. 61, no. 3, Sept. 1921, pp. 94-99. Notes on utilizing old tile drains; depth of drains; inlets and catch basins; rainfall and run-off; sizes of drains. Paper read before Ill. Soc. Engrs. (To be concluded.)

DROP FORGING

Design of Parts. The Art of Drop Forging with Examples of Work. Can. Machy., vol. 26, no. 12, Sept. 22, 1921, pp. 25-28, 4 figs. Discusses design of parts, additional strength due to drop forging, etc.

Dies. Design and Making of Drop-forging Dies. Machy. (N. Y.), vol. 28, no. 2, Oct. 1921, pp. 123-124. Methods of heating, quenching and drawing carbon and alloy-steel dies.

E

EDUCATION, INDUSTRIAL

Training of Metal Workers. The National Metal Trades Association and Industrial Education, Harold C. Smith. Mech. Eng., vol. 43, no. 8, Aug. 1921, pp. 521-522 and 550. Outline of its activities in training of new workers, with opinions of its committee on industrial education regarding apprenticeship, trade and continuation schools, instruction of foremen, training in plant, and vestibule schools.

ELECTRIC DISTRIBUTION SYSTEMS

Construction. Construction of Industrial Electrical Distribution Systems.—II, V. E. Johnson. Power Plant Eng., vol. 25, no. 19, Oct. 1, 1921, pp. 957-961, 14 figs. Manholes and underground work; interior wiring.

Mechanical Difficulties. Reducing Mechanical Difficulties With Motor-Driven Applications. Raoul Pruger and Louis A. Deesz. Elec. Jl., vol. 18, no. 9, Sept. 1921, pp. 408-413, 9 figs. Considers belted, geared, chain-driven and direct-connected drives, cushioned and uncushioned loads, etc.

ELECTRIC FURNACES

Annealing. Design Electric Annealing Furnace, C. E. Chaney. Foundry, vol. 49, no. 18, Sept. 15, 1921, pp. 720-723, 6 figs. Malleable iron is annealed in 42 hours.

Fuel-Fired, vs. Comparison of Electric Furnaces Practice with Fuel-Fired Furnace Practice, N. K. B. Patch. Am. Electrochemical Soc. advance paper, no. 22, for Meeting, Sept. 29-Oct 1, 1921, pp. 287-290. Author's experiences are that cost of metal melted, melting losses, and solution of gases in metal, are substantially the same in electric and fuel-fired furnace, provided intelligent operation is pursued.

Girod. Electric Furnaces for Making Steel—VI, Alfred Stansfield. Blast Furnace and Steel Plant, vol. 9, no. 9, Sept. 1921, pp. 550-552, 1 fig. Describes Girod electrode-hearth arc-furnace at Bethlehem Steel Co.

Gray-Iron. Electric Furnace Gray Iron, Jas. L. Cawthon, Jr. Elec. Jl., vol. 18, no. 9, Sept. 1921, pp. 396-400, 4 figs. Discusses economics compared with cupola, addition of silicon, temperature control, etc.

Heat-Treating. Electric Furnaces and Heat Treatment, Edwin F. Cone. Iron Age, vol. 108, no. 11, Sept. 15, 1921, pp. 643-648, 10 figs. Survey of their commercial application to steel and other industries.

Levoz. The Electric Furnace (Le Four Électrique). Revue d'Electrochimie et d'Electrometallurgie, vol. 15, no. 3-4, March-April 1921, pp. 57-61. Describes Levoz furnace which is capable of producing a good quality of metal with a minimum expenditure of electric power.

Muffled-Arc Type. Recent developments in Electric Furnaces of the Muffled Arc Type, H. A. Winne. Am. Electrochemical Soc., advance paper no. 19, for Meeting, Sept. 29-Oct. 1, 1921, pp. 263-272, 5 figs. Smaller units of 1500 lb. and 100 lb. per hr. capacity are described in comparison to larger rectangular shell-type furnace. Discusses advantages of muffled-arc furnace.

Non-Ferrous Metals. The Influence of the Electric Furnace on the Metallurgy of Non-Ferrous Metals, H. M. St. John. Am. Electrochemical Soc., advance copy, no. 3, pp. 55-57. Discusses gradual breaking down of secretiveness as to methods and results, melting of high quality brass and bronze in ton lots, more convenient and economical handling of charges, etc. (Abstract.)

Progress in 1921. Electric Furnace Progress in 1921, E. T. Moore. Iron Age, vol. 108, no. 12, Sept. 22, 1921, pp. 723-724. Discusses merits of dual voltages for melting steel and for refining. Heat losses and electrodes are considered. Report submitted to Assn. Iron and Steel Elec. Engrs.

Resistance Type. Resistance Type Electric Furnace in the Melting of Brass and Other Non-Ferrous Metals, T. F. Bailey. Am. Electrochemical Soc., advance paper, no. 20, for Meeting, Sept. 29-Oct. 1 1921, pp. 273-279. Discusses various features to be considered, and summarizes advantages and disadvantages of resistance-type as compared with other types.

Rotary. Rotary Electric Furnace Shows Marked Advantages, Alan D. Dauch. Elec. Wld., vol. 78, no. 12, Sept. 17, 1921, pp. 565-566, 2 figs. This furnace replaces oil-fired furnaces for continuous heat treating, annealing and carbonizing.

Superheats in. Superheat in the Electric Furnace, George K. Elliot. Foundry, vol. 49, no. 18, Sept. 15, 1921, pp. 714-719. Discusses temperature losses, temperature limit for cupola iron, deoxidation, limits of sulphur, etc.

Types. Electric Furnaces, Ezer Griffiths. Beama, vol. 9, nos. 2 and 3, Aug. and Sept. 1921, pp. 145-150, 5 figs., and 254-259, 4 figs. Describes carbon resistor furnace, vacuum furnace, furnaces for testing refractories and for experiments under high gaseous pressures; arc, induction high-frequency induction and vacuum cathode ray furnace.

ELECTRIC GENERATORS

Large Units. Large Electric Units, Stanley P. Smith. Engineering, vol. 112, no. 2907, Sept. 16, 1921, pp. 399-404. 26 figs. Considers methods of producing a. c. and d. c. energy, with notes on turbo-alternators, waterwheel and slow-speed alternators; d. c. generators, rotary and motor converters and mercury rectifiers. Paper read before British Assn.

Operating Temperatures. Generator Operating Temperatures, S. H. Mortensen. Power, vol. 54, no. 9, Aug. 30, 1921, pp. 319-320, 5 figs. The three classes of insulation employed to protect windings of electric generating machines. Operating-temperature limits. Methods used to determine accurately these temperatures.

ELECTRIC GENERATORS, A. C.

Repairing. Repairing Large Alternative-Current Generators-Rewinding, N. L. Rea. Power, vol. 54, no. 13, Sept. 27, 1921, pp. 475-477, 4 figs. Placing coils in slots; methods of heating coils; drying out machine; measuring insulation resistance; placing machine into service.

ELECTRIC LAMPS, INCANDESCENT

Standard Specifications. Standard Specifications for Large Incandescent Electric Lamps. Circular of Bur. Standards, Dept. Commerce, no. 13, July 30, 1921, 20 pp. Discusses specifications for tungsten filaments and carbon filament lamps.

Tungsten, Specification for. British Standard Specification for Normal Type Vacuum Tungsten Filament Electric Lamps. British Eng. Standards Assn., no. 133, June 1921. 12 pp. 1 fig. Definitions and specification. Tables giving size of lamp and initial watts per candle, total watts and test life.

ELECTRIC LOCOMOTIVES

Operating Characteristics. Operating Characteristics of the Electric Locomotive N. W. Storer. Ry. Rev., vol. 69, no. 6, August 6, 1921, pp. 169-173, 5 figs. Discusses charges due to general adoption of electrification and adaptability of electric locomotives.

Swiss. Electric Locomotives of the Bernese Railway (Locomotives électriques des chemins de fer Bernois), Lucien A. H. Pahin. L'Industrie Electrique, vol. 39, no. 701, Sept. 10, 1921, pp. 328-331. Data on 2-4+4-2 locomotives of 8000 kg. tractive effort, also mechanical and electrical equipment.

Electric Traction in Switzerland. Electrician, vol. 87, no. 2261, Sept. 16, 1921, pp. 348-352, 7 figs. Discusses freight-locomotive details, express locomotives 1-C-1 and 1-B+B-1, freight locomotive 1-C+C-1, and their electrical equipment. (Concluded.)

ELECTRIC MOTORS, A. C.

Induction. Some Recent Developments in Induction Motor Starting, Millard C. Spencer. Assn. Iron and Steel Elec. Engrs., vol. 3, no. 9, Sept. 1921, pp. 415-425, 7 figs. Discusses interchangeability, simplification in wiring, complete accessibility of all parts, etc.

Synchronous. Calculating Characteristics of Synchronous Machines, J. H. Kuhlman. Elec. Rev. (Chicago.), vol. 79, no. 10, Sept. 3, 1921, pp. 342-346, 3 figs. Tests determine actual data required to compute complete performance curves; method to be employed in calculating various values from test readings; curves computed from trial.

ELECTRIC MOTORS, D. C.

Controllers for. Controllers for D. C. Motors, W. J. John. Beama, vol. 9, no. 3, Sept. 1921, pp. 240-243. Advantages and disadvantages of various types.

ELECTRIC PLANTS

Equipment. Electrical Equipment Committee Report 1921, R. B. Gerhardt. Assn. Iron and Steel Elec. Engrs., vol. 3, no. 9, Sept. 1021, pp. 407-414. Discusses power house equipment, electric furnaces, etc.

ELECTRIC RAILWAYS

Hydroelectric. Royal Commission's Report on Proposed Hydro Electric Railways for Ontario. Can. Ry. and Mar. Wld., no. 282, Sept. 1921, pp 490-496. Concludes times is not opportune.

Third-Rail System. History and Comments on the Third Rail System. Proc. Jl. Pacific Ry. Club, vol. 5, no. 5, August 1921, pp. 17-30. Describes technical developments.

ELECTRIC SWITCHES

Magnetic Blow-Out. Arc Rupture in Magnetic Blow-Out Switches, O. H. Eschholz. Elec. Wld., vol. 78, no. 10, Sept. 3.1921, pp. 361-464, 8 figs. Arc lengths at which instability occurs are determined for practical conditions. Investigates effect of electrode materials, surfaces, etc. Discusses phenomena of arc formation and rupture.

Specification. British Standard Specification for Air-Break Knife Switches and Laminated Brush Switches for Pressurees Not Exceeding 660 Volts. British Eng. Standards Assn., no 190, July 1921, 12 pp. 1 fig. Definitions; rating, sizes and marking; design and construction; tests.

ELECTRIC TRANSMISSION LINES

Protection. Modern Methods of Sectionalizing Lines in Case of Overload (Les principales méthodes modernes de sectionnement des circuits électriques en cas de surintensités), P. Scoumanne. Revue Générale de L'Electricité, vol. 10, no. 9, Sept. 3, 1921, pp. 298-300, 2 figs. Describes Whitaker protection system.

ELECTRIC WELDING

Oil Tanks. Electric Welding of Oil Storage Tanks, William Schenstrom. Welding Engr, vol 6, no. 9, Sept. 1921, pp. 49-52, 7 figs. Discusses advantages of welded over riveted and need for standardized methods. Paper read before Am. Welding Soc.

ELECTRON METAL

See Magnesium Alloys, Electron Metal.

ELEVATORS

Electric. Electric Elevator Machinery-Elevator Cables, Their Care and Inspection, M. A. Myers. Power, vol. 54, no. 10, Sept. 6, 1921, pp. 369-371, 7 figs. Types of elevator rope, machines and accessories. Cable measurement.

Motor-Control Equipment Motor-Control Equipment Used in Elevator Service —I, G. J. Kirkgasser and E. W Seeger. Elec. Rev. (Chicago), vol 79, no. 13, Sept 24, 1921 pp. 465-468, 8 figs Machines, roping brakes and motors employed in operation of elevators; features of magnetic and mechanical controllers; diagrams and illustrations of circuits and control devices. (To be continued.)

EMPLOYMENT MANAGEMENT

Employment System. A Modern Factory Employment System, W. H. Rohr. Wood-Worker, vol 40, no. 7 Sept. 1921, pp. 27-29, 8 figs. Discusses the question of reducing labour turnover.

Hiring System. Efficient System of Hiring Men, Russel J. Waxldo. Machy. (N. Y.) vol. 28, no. 2, Oct. 1921, pp. 135-137, 7 figs. Methods adopted by large manufacturing plant for insuring selection of applicants best suited for work.

ENGINEERS

Education and. Making Better Engineers of College Men. Elec. Wld., vol. 78, no. 12, Sept 17, 1921, pp. 567-569. Power to think is more important than mind filled with facts.

The Character of the Engineer. Times Eng. Supp., no. 563, Sept. 1921, p. 259. Discusses natural qualifications and education as training. Believes there is room for all really fit.

ETHYLENE

Preparation From Acetylene. The Preparation of Ethylene by Hydrogenation of Acetylene, William H. Ross, James B. Culberston and J. P Parsons. Jl. Industrial and Eng. Chem., vol. 13, no. 9, Sept. 1921, pp 775-778, 3 figs Discusses preparation of nickel catalyst, apparatus and method, absorption of hydrogen, formation of ethane, yield of ethylene, and methods of analysis.

EVAPORATORS

Design. Studies in Evaporator Deisgn—V, W. L. Badger. Chem. and Met. Eng., vol. 25, no. 10, Sept. 7, 1921, pp. 459-463, 5 figs. Experimental data for horizontal-tube evaporator showing relation between hydrostatic head, temperature drop and heat transmission. Read before Am. Inst. Chem. Engrs.

EXTRUSION OF METALS

Extrusion Defect. The Extrusion Defect, R. Genders. Inst. Metals advance paper for meeting Sept. 21-22, 1921, no. 7, 9 pp. 12 figs.;also Engineering, vol. 112, no. 2909, Sept. 30, 1921, pp. 487-489, 12 figs. Describes method which is said to be successful in avoiding formation of extrusion defect, and is in use in many places for production of tubes and rod from soft metals such as lead and aluminum. Writer suggests its use for extrusion of copper alloys.

F

FACTORIES

Maintenance. Factory and Plant Maintenance—II, Arnold A. Arnold. Mech. World, vol. 70, no. 1811, Sept. 16, 1921, pp. 222-223. Discusses various works plans that it may be advisable to keep an information they record, also inventory of machinery and plant. (To be continued.)

FLAME PROPAGATION

Definition. Flame, C. A. French. Jl. Soc. Automotive Engrs., vol. 9, no. 3, Sept. 1921, pp. 182-185 and (discussion) 185-188, 1 fig. Discusses definition of atomic theory, combustion, oxidation and flame propagation.

FORGINGS

Ordnance, Heat Treatment of. Observations Made in the Heat Treatment of Ordnance Forgings, Paul E. McKinney. Trans. Am. Soc. for Steel Treating, vol. 1, no. 12, Sept. 1921, pp. 738-745, 3 figs. Shows the necessity of having most complete data on material handled for successful heat treatment and to avoid erroneous deductions.

Press. A Method of Designing Press Forgings, W. R. Ward. Forging and Heat Treating, vol. 7, no. 8, August 1921, pp. 428-430 Combination of practical and theoretical gives best results working from finished forging back to billet.

FOUNDRIES

Core Room. Improved Core Output from Smaller Space. Iron Age, vol. 108, no. 15, Oct. 13, 1921, pp 927-929, 4 figs. By providing improved working conditions for girl core makers, better product and higher type of employee have been secured.

Electric Suspension Travellers. Electric Suspension Traveller in Foundries, Richard Hänchen. Eng. Progress, vol. 1, no. 5, May 1920, pp. 181-185, 10 figs. Describes types made by various manufacturers.

Ford Motor Co. New Ford Foundry Plant at River Rouge, L. B. Breedlove. Iron Age, vol. 108, no. 13, Sept. 29, 1921, pp. 787-793, 7 figs. Laid out for quantity production. Uses direct blast-furnace metal mixed with cupola metal in definite proportions as required. Conveyor systems highly developed.

Malleable Iron. Equipment Features Malleable Shop, H. E. Diller. Iron Trade Rev., vol. 69, no. 15, Oct. 13, 1921, pp. 935-942 and 950, 14 figs. Details of new foundry of American Chain Co., New York, located at York, Pa., showing radical departures from general practice in all three stages of conveying, melting and annealing.

Manufacturing System. Manufacturing System Applied to the Foundry. Machinery (Lond.), vol. 18, no. 466, Sept. 1, 1921, pp. 664-671, 20 figs. Review of system developed by Derwent Foundry Co (1920), Ltd., Derby.

Mixtures. Figuring the Charges for Foundry Irons, Y. A. Dyer. Iron Age, vol. 108, no. 15, Oct. 13, 1921, pp. 931-933 Iron mixtures and how to figure them chemically. Classification of castings and suggested analyses.

FREIGHT-HANDLING

Slow Traffic. On the Question of Slow-Freight Traffic, W. H. Williams. Bul. International Ry. Assn., vol. 3, no. 8, August 1921, pp. 1087-1101, 2 figs. Discusses loading and unloading, yard and train operation, freight car movement, freight rates, etc.

FUELS

Coke Breeze as Boiler Fuel. Value of Mixture of Coke Breeze and Bituminous Coal as Fuel for a Hand-Fired Boiler, John Blizard and James Neil. Jl. Am. Soc. Heating & Ventilating Engrs., vol. 27, no. 6, Sept. 1921 pp. 645-655, 2 figs.

Influence on Engine Porformance. The Influence of Various Fuels on Engine Proformance—V, H R. Ricardo. Automotive Industries, vol. 45, no 5, August 4, 1921, pp. 211-216, 11 figs. Relation between mixture strength and indicated mean pressure for various fuels, compression ratios and spark timing is shown and influence of jacket water temperature and heating of charge determined. From preliminary report conducted for Asiatic Petroleum Co.

Smokeless. The Present Position of Smokeless Fuels, F. S. Sinnatt. Iron and Coal Trades Rev. vol. 103, no. 2790, August 19, 1921, p. 233. Concludes that manufacture of some type of smokeless fuel would solve the problems of fuel conservation, air pollution and efficient house heating, coal should be worked at pithead or in conjunction with coal gas. (Abstract.) Paper read before Royal Sanitary Inst.

See also Oil Fuel; Pulverized Coal.

FURNACES

Preheated-Air vs. Direct Fired. Experimental Comparison of a Preheated Air Furnace With a Direct Fired Furnace, L. Lellep. Am. Gas Jl., vol. 115, no. 12, Sept. 17, 1921, pp. 247-252 and 260-263, 4 figs. Discusses results of experiments and gives table of theoretical computation of fuel saving due to preheated air compared with fuel consumption in a direct-fired furnace.

FURNACES, BOILER

Recovery of Unburned Fuel from Refuse. The Recovery of Unburned Fuel from Boiler Furnace Refuse, Thomas Fraser and H. F. Yancey. U. S. Bur. Mines Reports of Investigations serial no. 2281, Sept. 1921, 3 pp. Washing tests made in laboratory of mining department of University of Illinois show possibility of recovering unburned fuel by crushing refuse to ¼-in. ring size, washing on coal-washing tables, and removing bone from washed product by a dewatering conveyor-elevator or screen.

FURNACES, HEATING

Regenerative. Employ Regenerative Furnaces, E. C. Kreutzberg. Iron Trade Rev., vol. 69, no. 11, Sept. 15, 1921, pp. 680-683, 7 figs. Installation at Harrison, N. J., comprises 24 units, to burn either oil or gas. Operation is explained and results of tests are given.

FURNACES, HOT-AIR

Small Blowers for. Small Blowers in Combination with Furnaces for Domestic Heating Plants, F. R. Still. Jl. Am. Soc. Heating and Ventilating Engrs. vol. 27, no. 6, Sept. 1921, pp. 659-663, 2 figs. Describes type of air-blast inductor and its application to hot-air furnaces.

G

GAGES

Snap. Tools Used in the Manufacture of P. & W. Adjustable Limit Snap-Gage, Ellsworth Sheldon. Am. Mach., vol. 55, nos. 11 and 12, Sept. 15 and 22, 1921, pp. 428-431 and 456-460, 24 figs. Sept. 15: Accurate alignment a prime requiste. Tool that drills a "cut-out" or crescent-shaped hole. Sept. 22: Making measuring anvils; accurate grinding operatinns; an ingenious lapping device.

Thread. New Type of Thread Gages, B. M. W. Hanson. Machy. (N. Y.), vol. 28, no. 2, Oct. 1921, pp. 110-111, 3 figs. Describes accurate method of determining correctness of screw threads by vision as well as by touch.

GAS TURBINES

Holzwarth. The Internal- Combustion Turbine, Mark Meredith. Oil Field Eng., vol. 23, no. 9, Sept. 1921, p. 130. Describes "Holzwarth" oil turbine now being tested at works of Thyssen & Co., Germany; develops 500 hp. at 3,000 r.p.m.

GASOLINE

Absorption from Casinghead gas. The Absorption of Gasoline From Casinghead Gas by Activated Charcoal, H. R. Auerswald. Mech. Eng., vol. 43, no. 9, Sept. 1921, pp. 601-602 and 606, 2 figs. Particulars regarding series of tests undertaken to evaluate process when applied to rich gas, with conclusions drawn therefrom as to its limitations.

Natural-Gas. Natural Gas-Gasoline Blends, D. B. Dow. U. S. Bur. Mines Reports of Investigations, serial no. 2279, Sept. 1921, 2 pp. Notes on how it is made. Includes table showing distillations of raw natural gas-gasoline, blending naphthas, and resulting blends.

GASOLINE ENGINES

Mixture Ratio and Temperature. The Effect of Mixture Ratio and Temperature on Power and economy, C. S. Kegerreis. Automotive Industries, vol. 45, no. 13, Sept. 29, 1921, pp. 610-612, 5 figs. Tests conducted at Purdue Univ. show that marked gains in economy with but trifling loss in power result from proper heating of charge and correct mixture proportions.

GEARS

Compressive Stress. Gearing Calculations by the Compressive Stress Method—I, Joseph Jandasek. Automotive Industries, vol. 45, no. 11, Sept. 15, 1921, pp. 512-515, 15 figs. Maximum surface pressure, or compressive stress, must be considered if rate of wear of tooth is to be kept within proper limits.

Elliptical Wheels. The Design of Elliptical Wheels for a Constant Speed Reciprocating Motion—II, Osbert H. Nichols. Machinery (Lond.), vol. 18, no. 469, Sept. 22, 1921, pp. 754-756, 3 figs. Discusses proportions and effect of elliptical wheels, as used for modifying simple harmonic motion.

Helical. Cutting Rolling Mill Driving Gears. Machinery (Lond.), vol. 18, no. 470, Sept. 29, 1921, pp. 787-790, 5 figs. Discusses production of large double helical gears by end milling process.

Involute, Testing. Inspection of Involute Gear Hobs—II, Carl G. Olson. Machy. (N. Y.), vol. 28, no. 2, Oct. 1921, pp. 138-140, 6 figs. Methods used in examining test gears.

GRINDING

Automobile Parts. Grinding in the Automotive Industry—IV, P. M. Heldt. Automotive Ind., vol. 45, no. 9, Sept. 1, 1921, pp. 421-426, 12 figs. Discusses methods used in grinding crankshafts, flat faces, camshafts, gear teeth, splines and other parts. (Concluded.)

GRINDING MACHINES

Internal. Grinding Irregular-Shaped Holes on the Bryant Internal Grinding Machine. Am. Mach., vol. 55, no. 13, Sept. 29, 1921, pp. 494-509, 7 figs. Handling combinations of straight, tapered and curved internal surfaces. Grinding done in one operation. Laying out special control plates.

H

HARDNESS

Testing. The Hardness Testing of Metals. Mech. Eng., vol. 43, no. 7, July 1921, pp. 445-449, 11 figs. Report of Committee of Engineering Division of Nat. Research Council on various methods of testing hardness of metals.

HEALTH

Plant Medical Department. Practices and Functions of the Medical Department. Robert E. Andrews. Indus. Management, vol. 62, no. 4, Oct. 1921, pp. 206-211, 6 figs. Experiences and procedure in medical department of large textile industry.

HEAT TRANSMISSION

Buildings. Heat Loss Through Various Types of Building Construction, L. A. Scipio. Jl. Am. Soc. Heating and Ventilating Engrs., vol. 27, no. 6, Sept. 1921, pp. 637-643, 2 figs. Results of series of experiments carried out to determine heat losses from different wall constructions for residence buildings, for which five houses exactly similar with exception of wall material and construction were built and heated by electric stoves for observation.

Furnaces, Losses in. Principles of Heat Loss in Furnaces, P. Rosin. Forging and Heat Treating, vol. 7, no. 8, August 1921, pp. 425-428, 1 fig. Study of heat losses through a furnace wall consisting of at least two different parts, a refractory material and an insulating material. Extract of article from "Metall and Erz".

Liquids. Numerical Laws of Heat Transmission Between Liquids in Industrial Heat Exchangers (Lois numériques de la transmission de la chaleur entre les fluides dans les échangeurs industriels), H. Dieterlen. Chaleur et Industrie, vol. 2, no. 16, August 1921, pp. 494-500, 4 figs. Discusses various formulas in use and finds them contradictory. (Continuation of serial.)

Problems. Solution of Heat Transfer Problems, H. G. Newitt. Power Plant Eng., vol. 25, no. 17 Sept. 1, 1921, pp. 849-850, 1 fig. Discusses chart for determining mean temperature difference in a heat-transfer problem when initial and final temperature differences are known.

HEAT TREATING

Oil-Burning System. Screw Stock Heat Treated With Oil, F. J. Ryan. Iron Age, vol. 108, no. 11, Sept. 15, 1921, pp. 660-661, 3 figs. Application of Mires system to ferrous and non-ferrous material by Bridgeport Screw Co. Operating data.

HEATING, STEAM

Boiler Improvements. Fuel Economy in Heating Service, A. Bement. Heat. and Vent. Mag., vol. 18, no. 9, Sept. 1921, pp. 36-38. Comments on present practice in down-draft boiler design with suggestions for improvements.

HELICOPTERS

Types. Helicopters (Les Hélicoptères), L. Guguet. L'Aerophile, vol. 29, nos. 13-14, July 1-15, 1921, pp. 209-213, 6 figs. Discusses Austrian army captive type, Oehmichen, Pateras, Pescara, and other types.

HIGHWAYS

Standard Specifications. Report of Committee on Standard Specifications for Highways, H. S. Carpenter. Jl. Eng. Inst. Can., vol. 4, no. 9, Sept. 1921, pp. 482-485, 6 figs. Progress report dealing with standard specifications for earth roads

HYDRAULIC TURBINES

Installation. The Hydraulic Plant—II, N. L. Devenford. Power, vol. 54, no. 14, Oct. 4, 1921, pp. 513-516, 6 figs. Types of turbine setting, forms of draft tube, effect of air leakage, vertical vs. horizontal turbines, thrust bearings, maintenance and repairs.

Pelton Wheels. An Experimental Study of the Effect of Roughness of Bucket Surface on the Efficiency of Pelton Wheel, Junzo Nakahara. Jl. Soc. Mech. Engrs. and Soc. Nav. Architects, Sept. 1921, (In Japanese.)

Types. The Hydraulic Plant—I, N. L. Devendorf. Power, vol. 54, no. 13, Sept. 27, 1921, pp. 484-486, 4 figs. Methods of removing débris from water in high-and low-head plants, types of hydraulic turbine employed, their limitations and means for effecting regulation.

HYDROELECTRIC DEVELOPMENTS

Great Britain. Hydro-Electric Developments—I, F. Rowlinson. Beama, vol. 9, no. 3, Sept. 1921, pp. 224-230, 1 fig. Summarizes developments in North Wales, Scotland and Ireland.

HYDROELECTRIC PLANTS

Brizal. Sorocaba Hydro-Electric Plant in Brazil, H. P. Quick. Power, vol. 54, no. 15, Oct. 11, 1921, pp. 548-551, 6 figs. Developments planned for 75,000 hp. in five 15,000-hp. turbines operating under a 600-ft. net effective head. Designed and put into successful operation by American engineers.

Kern River, Cal. Automatic Features of New Kern River Power Plant. Eng. News-Rec., vol. 87, no. 11, Sept. 15, 1921, p. 453. Reaction turbines for 810-ft. head have quickly changeable runners. Extensive automatic control equipment.

Manitoba, Canada. New Plant on Winnipeg River. Can. Engr., vol. 41, no. 10, Sept. 8, 1921,, pp. 1, 6 and 8. Great Falls development to have capacity of 168,000 hp., with six 28,000-hp. units. Details of head gates, screens, hydraulic turbines, generators, transformers, switching apparatus and transmission lines.

Switzerland. Constructional Details of the Oberhasli Hydroelectric Works (Les dispositions constructives des usines hydro-électriques de l'Oberhasli). Bulletin Technique de la Suisse Romande, vol. 47, no. 17, August 20, 1921, pp. 193-198, 7 figs. Discusses hydrographic conditions, construction of dams, reservoirs, etc. (To be continued.)

I

IMPACT

Stress Recorder. Fereday and Palmer's Patent Stress Recorder. Ry. Gaz., vol. 35, no. 7, August 12, 1921, pp. 283-285, 27 figs., partly on supp. pl. Describes an instrument for recording impact stresses on railway bridges by a train passing at high speed.

INDICATORS

Diagrams. Taking Indicator Diagrams, P. A. Baumeister. Power, vol. 54, no. 15, Oct. 11, 1921, pp. 551-552, 4 figs. Points out requirements and necessary steps for getting good indicator diagrams.

Steam-Engine, High-Speed. A new Design of High Speed Engine Indicator, Benno R. Dierfeld. Automotive Ind., vol. 45, no. 10, Sept. 8, 1921, pp. 471-473, 15 figs. German instrument employs steel pencil to trace extremely small diagram on soot-covered glass plate which is enlarged by use of microscope.

INDUSTRIAL MANAGEMENT

Factory Investigations. Economic Value of Factory Investigations, Albert A. Dowd. Machy. (N. Y.), vol. 28, no. 2, Oct. 1921, pp. 121-122. Gives examples of cost reductions resulting from investigations. Improved method of manufacturing a long rod. Notes on handling materials, inspection and salvage, time studies and assembling.

Gantt Charts. The Gantt Chart—III, Wallace Clark. Management Eng., vol. 1, no. 4, Oct. 1921, pp. 225-229, 4 figs. Its application to progress of work.

Intra-Plant Communication. A Development in Intro-Plant Communication, Donald McNicol. Management Eng., vol. 1, no. 4, Oct. 1921, pp. 235-237, 3 figs. Describes how printing telegraph may be employed to supplement telephone in solving problem of plant communication.

Objections Made to. Scientific Management—XXXI, Henry Atkinson. Eng. and Indus. Management, vol. 6, no. 11, Sept. 15, 1921, pp. 286-289. Examination of objections made against scientific management.

Production, Economics of. The Economics of Production—IV, V and VI, D. A. McCabe. Am. Mach., vol. 55, nos. 11, 12, 13 and 14, Sept. 15, 22, 29, and Oct. 6, 1921, pp. 419-420, 455-456, 497-498 and 539-540. Sept. 15: Causes of changes in demand. Sept. 22: Production and reduced demand. Sept. 29: Producer's job and profits. Oct. 6: Production and wages.

Production Methods. Modern Production Methods—XXI, XXII and XXIII, W. R. Basset. Am. Mach., vol. 55, nos. 11, 13 and 15, Sept. 15, 29 and Oct. 13, 1921, pp. 421-423, 501-505 and 604-608, 13 figs. Sept. 15: Graphic methods of control; when to use graphic charts and when not to; master charts. Sept. 29: Various uses of time studies; attitude of workman; some general rules for time-study observer. Oct. 13; Records of actual time studies of machine operations; fallacy of taking over-all times for standards.

Protection Control by Graphics, Fred R. Daniels. Machy. (N. Y.), vol. 28, no. 2, Oct. 1921, pp. 112-120, 14 figs. System employing graphic charts for controlling shop operations in use in plant of Hopedale Mfg. Co., Milford, Mass.

Production Planning. Quality and Costs as Standards of Production (Güte und Kosten als Grundmassstäbe der Produktion), H. Basson. Betrieb, vol. 3, no. 22, Aug. 13, 1921, pp. 695-703, 12 figs. States that quality and cost of product are influenced by fitness of design and quality of materials used, as well as by accuracy of production, etc. Based on practical examples, errors in design, possibilities for economizing in material, and accuracy of production are discussed.

Works Organization, R. Waring-Brown. Eng. and Indus. Management, vol. 6, no. 14, Oct. 6., 1921, pp. 377-382, 9 figs. Production engineer's planning department in automobile factory.

Routing. Charting Routing Losses. Factory, vol. 27, no. 3, Sept. 1921, pp. 328-329, 2 figs. Graphic method of locating source of trouble. Experience of Am. Optical Co.

Simplification. Simplification in Industry—VII, Howard Coonley. Factory, vol. 27, no. 3, Sept. 1921, pp. 317-319, 4 figs. How line was reduced from 17,000 to 610 items. Describes how simplification facilitated development of suitable budget of business and opened way to other advantages.

Small Shop. Organization and Management of the Small Shop—V, VI and VII, E. W. Leach. Am. Mach., vol. 55, nos. 11, 13 and 15, Sept. 15, 29 and Oct. 13, 1921, pp. 438-441, 513-516, and 592-595, 7 figs. Sept. 15: Production planning and control. Necessity and uses of system. Figuring shop capacity. Simple method of cost-keeping. Sept. 29: Value of cost records: what profit should be based upon. Classification of material and labour accounts; overhead and what it consists of. Oct. 13: Filling customer's order; necessity of keeping records; efficiency in shipping room.

Stock-Record Keeping. Worth while Considerations in Stock Record Keeping, F. E. Merriam. Indus. Management, vol. 62, no. 4, Oct. 1921, pp. 199-205, 9 figs. Defines duties and scope of stock-record department, and its relation to management.

Tracing Materials. Making It Easy to Trace Materials, L. E. Dodd. Factory, vol. 27, no. 3, Sept. 1921, pp. 330-332, 5 figs. Plan for recording material in factory that readily permits tracing it back to its source or ahead to its ultimate destination. Developed in Optical Glass Plant of Nat. Bur. of Standards, Pittsburgh and Washington.

See also Motion Study.

INDUSTRIAL RELATIONS

Human Factor. The Human Factor in Industry—I, Clarence H. Northcott. Indus. Management, vol. 62, no. 4, Oct. 1921, pp. 195-198. How the man grew above the machine.

INSPECTION

Delco System. The Delco Inspection System. Machinery (Lond.), vol. 18, no. 460, July 21, 1921, pp. 468-471, 8 figs. Description of methods used in tool and gage-designing department of Dayton Eng. Laboratories Co. and standards of gaging adopted.

INSULATORS, ELECTRIC

Suspension. Flashover of Insulators for 220-Kv. Lines, H. J. Ryan, H. H. Henline and F. F. Evenson. Elec. Wld., vol. 78, no. 12, Sept. 17, 1921, pp. 561-565, 16 figs., partly on p. 560. Flashover characteristics of suspension insulators, including V-strings and composite strings with shielding devices. Condensed from paper delivered before San Francisco section of Am. Inst. Elec. Engrs.

INTERNAL-COMBUSTION ENGINES

Frictional Losses. Distribution of Frictional Losses in Internal Combustion Engines, E. P. Taylor. Gas and Oil Power, vol. 16, no. 192, Sept. 1, 1921, pp. 190-192. Describes a number of tests and concludes that the retardation method offers the advantages of accuracy and complete speed range with the disadvantage that values of friction are obtained under special conditions. (From Jl. Proc. Roy. Soc. of New South Wales.)

Fuel, Valves and Ignition. The Internal-Combustion Engine Fuel Valves, and Ignition, A. W. Bradbury. Mech. Wld., vol. 70, no. 1809, Sept. 2, 1921, p. 193. Discusses chemical and mechanical work done in combustion chamber. (To be continued.) From paper read before Inst. Mar. Engrs.

Fuels, Influence of. The Influence of Various Fuels on Engine Performance—VI, H. R. Ricardo. Automotive Industries, vol. 45, no. 10, Sept. 8, 1921, pp. 465-470 and 476, 6 figs. Outlines tests intended to determine conditions which govern ease of starting with various fuels and effect of fuel upon volumetric efficiency. (To be continued.) From preliminary report conducted for Asiatic Petroleum Co.

The Influence of Various Fuels on the Performance of Internal Combustion Engines—VII, H. R. Ricardo. Automobile Engr., vol. 11, no. 153, August 1921, pp. 279-284, 5 figs. Gives tables of fuel characteristics and experimental results for variable compression engines.

Two-and Four-Cycle. The Internal Combustion Engine Discussed. A. W. Bradbury. Power House, vol. 14, no. 17, Sept. 5, 1921, pp. 32-36, 14 figs. Discusses two-cycle and four-cycle types, their advantages and disadvantages. Read before Inst. Mar. Engrs.

See also Aeroplane Engines; Automobile Engines; Diesel Engines; Gasoline Engines; Oil Engines.

IRON

Stainless. Stainless Iron. Times Eng. Supp., no. 563, Sept. 1921, p. 257. A variant of stainless steel, mechanical properties, corrosion and errosion.

IRON AND STEEL

Canada. Status and Future of the Canadian Iron and Steel Industry. Iron and Coal Trades Rev., vol. 103, no. 2791, August 26, 1921, p. 265. Discusses coal resources and gives summary of conclusions. (Continuation of Serial.)

Microscopic Examination. Microscopic Examination of Iron and Steel. Chem. and Met. Eng., vol. 25, no. 10, Sept. 7, 1921, pp. 471-472. Report of committee appointed by Am Soc. for Testing Materials on methods for testing iron and steel.

IRON MINING

Lake Superior District. Iron Mining in the Lake Superior District, J. C. Metclaf. Min. and Metallurgy no. 178, Oct 1921, pp. 35-38, 6 figs. Notes on underground and steam-shovel mining. Difficulties in maintaining grades.

L

LABOR TURNOVER

Causes. Why men Quit, H. L. Keely. Indus. Management, vol. 62, no. 4, Oct. 1921, pp. 223-227, 3 figs. Simple method of recording caused classifying them, and making record of practical use to management.

LATHES

Bench. Bench Lathes and Millers as Production Tools. Machy. (N. Y.), vol. 28, no. 2, Oct. 1921, pp. 130-134, 9 figs. Examples of work regularly manufactured on bench machines by B. C. Ames Co., Waltham, Mass.

Large. A Very Large Lath. Engineer, vol. 132, no. 3430, Sept. 23, 1921, pp. 325-326, 3 figs., two on supp. plate. Describes sliding, surfacing and screw-cutting lathe built by Thomas Shanks & Co., Johnstone. Principal dimensions are: Height of centers without packing, 111 in.; and with packing, 123 in.; admit between centers, 40 ft.; width of slide bed, 18 ft. 6 in.; overall length of bed, 60 ft.; diam. of face-plate, 15 ft.; main motor, 120 hp.

Motor-Driven Heavy. Recent Machine Tool Developments—XXI, Joseph Horner. Engineering, vol. 112, no. 2906, Sept. 9, 1921, pp. 364-367, 12 figs. Motor-driven heavy lathe of 20-in. centers, constructed by Francis Berry & Sons, Sowerby Bridge, England.

Turret. Improving Tool Equipments. Hubert Bentley. Eng. and Indus. Management, vol. 6, no. 10, Sept. 8, 1921, pp. 265-266, 3 figs. Describes hexagon turret toolholder, use of which, it is claimed, increases productivity of machine and prolongs life of tool.

Production Work in the Locomotive Shop—I. Machy. (N. Y.), vol. 28, no. 2, Oct. 1921, pp. 102-105, 10 figs. Application of Bullard vertical turret lathe to locomotive-shop practice, with typical examples and description of tooling for each job.

10-In. Automatic Turret Lathe. Engineering, vol. 112, no. 2909, Sept. 30, 1921, pp. 463-467, 44 figs.partly on supp. plate. Details of automatic turret lathe constructed by Gisholt Machine Co., Madison, Wis. Swing of lathe is 20 in., maximum distance between chuck and turret is 45 in. and maximum length of work which can be handled 14 in.; overall length, 11 ft. 10 ⅜ in.; weight, 10,000 lb. It can be driven by electric motor or belt.

Vertical. An Original Type of Lathe. Eng. Production, vol. 3, no. 49, Sept. 8, 1921, pp. 219-220, 1 fig. Details of vertical lathe made by Cadillac Tool Co., Detroit, which can be used for turning, facing and grooving operations.

LOCOMOTIVES

Booster Tests. Booster Test on Temiskaming and Northern Ontario. Ry. Age, vol. 71, no. 10, Sept. 3, 1921, pp. 447-448, 4 figs. Results of tests of locomotive booster show 20 per cent increased freight tonnage and rapid acceleration of passenger trains.

British. The Comparison of Dimensions and Proportions of British Locomotives, L. C. Poultney. Ry. Mech. Engr., vol. 95, no. 9, Sept. 1921, pp. [illegible]-512, 1 fig. Discusses factor of adhesion, rated tractive effort, boiler factor, factors of combustion, firebox volume, efficiency, etc. (To be continued.)

Design and Operation. The Necessity for Improvement in the Design and Operation of Present-Day Locomotives, H. W. Snyder. Mech. Eng., vol. 43, no. 7, July, 1921, pp. 455-458, 1 fig. Brief discussion of engine problems followed by consideration of design of main and side rods and crankpins to withstand tremendous piston thrust to which they are subjected in large engines, problem of counterbalancing; frame design and cross-bracing, driving-box brasses, ash-pan design, lubrications, etc.

4-6-0- Express Goods. Four-Cylinder Express Goods Locomotives on the Great Central Railway. Ry. Gaz., vol. 35, no. 10 Sept. 2, 1921, pp. 368-369, 2 figs. Type 4-6-0, tractive effort 29,507 lb. at 85 per cent boiler pressure.

4-6-0 Three-Cylinder. New Three-Cylinder 4-6-0 Type Locomotives, Caledonian Railway. Ry. Gaz., vol. 35, no. 13, Sept. 23, 1921, pp. 463, 2 figs. on page 464. Three 8½-in. single-expansion cylinders, six coupled wheels of medium diameter, and 60 tons of adhesion.

Freight. Advantages of Large Freight Locomotives. Particularly the 2-10-2 Type, Albert F. Stuebing. Mech. Eng. vol. 43, no. 7, July 1921, pp. 459-460. Points out more important considerations involved in study of economic value of various types of motive power and demonstrates complexity of problem.

Liquid Fuel. On the Utility of Studying the Question of the Use of Liquid Fuel in Locomotives, Henry Fowler. Bul. International Ry. Assn., vol. 3, no. 8, August 1921, pp. 923-976, 11 figs. Discusses a number of questions sent to R. R. administrations on their using liquid fuel and gives tabulated statement of replies received.

Mikado'. New Locomotive for the Missouri Pacific Ry. Age. vol. 71, no. 11, Sept. 10, 1921, pp. 495-498, 4 figs. Data on Mikado type equipped with booster, switcher, Pacific and mountain types.

Oil-Firing. Oil-Firing on English Railways E. C. Bowden-Smith. Petroleum Times, vol. 6, no. 139, Sept. 3, 1921, pp. 617-618, 1 fig. Describes working of a Great Central tank locomotive burning oil.

Superheater. Three-Cylinder Superheater Steam Goods Train Locomotive. Type 2-10-0, G. Heise. Eng. Progress, vol. 1, no. 5, May 1920, pp. 191-195, 25 figs. Describes types built by Lokomotiv-Bauanstalt Henschel & Sohn.

2-8-0 Belgian State Railways. Powerful New 2-8-0 Type Locomotives For the Belgian State Railways. Ry. Gaz., vol. 35, no. 7, August 12 1921, pp. 286-287, 5 figs. Built by Armstrong, Whitworth & Co., for mixed traffic; develops tractive force of 45,820 lb.

Weighing Plant. A Large Capacity Locomotive Weighing Plant, Carl C. Bailey. Ry. Age. vol. 71, no. 10, Sept. 3, 1021, pp. 453-455, 5 figs. Heavy scale is housed in special buildings with equipment for determining wheel loads.

LUBRICATION

Car Journals. Lubrication of Car Journals Without the Use of Waste. Ry. Rev., vol. 69, no. 9, August 27, 1921, pp. 267-271, 6 figs. Particulars of tests conducted to determine relative advantages of splash-oil lubrication vs. waste-packed method.

M

MACHINE SHOPS

Design and Construction. The Design and Construction of Engineering Workshops—XXII. Ernest G. Beck. Mech. Wld., vol. 70, no. 1810, Sept. 9, 192 pp. 202-203, 2 figs. Continuation of discussion on construction of roofs.

MACHINE-TOOL INDUSTRY

Influence of Automobile on. The Influence Exerted by the Automobile on Machine-Tool Industry. Mech. Eng., vol. 43, no. 8, Aug. 1921, pp. 529-53 fig. Group of papers by F. K. Hendrickson, Henry J. Eberhardt, Henry Hinde, Ralph E. Flanders and Chester B. Lord, dealing with changes brou about by automobile in machine-tool design, construction and operation, t ther with discussion of fundamentals of interchangeable manufacture.

MACHINE TOOLS

Special vs. Standard. Manufacturing with Special Machines vs.. Sta rd Equipment—V, G. F. Jenks and M. H. Christopherson. Am. Mach., v 55, no. 12, Sept. 22, 1921, pp. 475-479, 12 figs. Lapping cylinders; testi and assembling. Comparison of machining times at Otis Works and Wat own Arsenal.

MALLEABLE IRON

American. American Malleable Cast Iron—XIX, H. A. Schwartz. Iron Trade Rev., vol. 69, no. 13, Sept. 29, 1921, pp. 813-816, 1fig. Inspection and testing.

MANGANESE STEEL

Carbonizing. Carbonizing Manganese Steel, A. A. Blue. Forging and Heat Treating, vol. 7, no. 8, August 1921, pp. 413-415, 4 figs. States that increased manganese content produces greater sensitiveness to carbonizing.

MARINE ENGINES

Broken Propeller Blades. Examples of Broken Propeller Blades of Marine Engines, S. Sasaki. Jl. Soc. Mech. Engrs. and Soc. Nav. Architects, Sept. 1921. (In Japanese.)

MARINE STEAM TURBINES

Diaphragms. Turbine Diaphragms, H M. David. Mech. Wld., vol. 70, no. 1809, Sept. 2, 1921, pp 181-183, 7 figs. Examines question from mechanical and constructional point of view; discusses type applying more particularly to marine turbines of impulse type having double reduction gear.

Geared. Double-Reduction Gearing of the Three-Case Type for Steamships. Engineering, vol 112, no. 2906, Sept. 9, 1921, p. 376, 2 figs. on. supp. plate. Constructed by Scotts Shipbuilding and Eng. Co., Ltd., Greenock, England, for single-screw vessel; transmits 6000 shaft hp.; high-pressure and low-pressure turbines have speed of 3,000 and 18,000 r.p. m., respectively.

Angular Vibrations in Marine Propelling Machinery, Richard Gardener. Engineering, vol. 112, no 2906, Sept. 9, 1921, pp. 363-364, 3 figs. Investigation of vibration effect in relation to geared steam turbine installations Proposes method for obtaining comparative estimates of outside limits to amplitude of vibration in gearing.

METAL SPRAYING

Schoop Process. The Schoop Process of Metal Spraying. Am. Mach., vol. 55, no. 16, Oct. 20, 1921, pp 647-648, 6 figs. Protective coating of metal sprayed by compressed air. Impalpable particles discharged at high velocities penetrate pores. Variety of metals can be used.

METALS

Alkaline. Experiences with the Alkaline and Alkaline Earth Metals in Connection with Non-Ferrous Alloys, Charles Vickers. Am. Electrochemical Soc. advance paper no. 14, for Meeting, Sept. 29-Oct. 1, 1921, pp. 191-198. Sodium of the alkaline metals, is said to serve as suitable deoxidizing agent in producing copper castings of superior torsional strength; calcium, of alkaline earth metals, when in combination with an acid element, as silicon, produces castings of good electrical conductivity.

Fatigue. The Fatigue of Metals, Clifford W. Nash. Commonwealth Engr., vol. 8, no. 12, July, 1, 1921, pp. 250-253 Discusses fatigue and elastic limit, endurance limit, mechanism of fatigue failure, and conditions favoring resistance to fatigue.

Rigidity and Viscosity. The Effect of Temperature on the Modulus of Rigidity, and on the Viscosity of Solid Metal, Kei Iokibe and Sukeaki Sakai. Lond., Edinburgh, and Dublin Philosophical Mag. and Jl. Sci., vol. 42, no. 249, Sept. 1921, pp. 397-418, 17 figs. Gives results of experiments carried out with 13 different metals to measure rigidity and logarithmic decrement at ordinary and high temperatures.

MICROMETERS

Accuracy. Checking the Accuracy of Micrometer Measurements, Ellsworth Sheldon Am. Mach., vol. 55, no. 14, Oct. 6, 1921, pp. 563-564. Notes on close measurements with micrometer, possibilities of error due to mechanical defects.

Recording Ultra. The Recording Ultra-Micrometer, John J. Dowling. Engineering, vol. 112, no. 2906, Sept. 9, 1921, p. 395, 1 fig. States that both in physical laboratory and engineering measurements of minute strains, displacements, expansions and the like, can be carried out with a degree of refinement altogether out of proportion with simplicity and reliability of apparatus. All measurements can be made from a distance and can be recorded by a recording galvanometer if desired. Paper read before British Assn. at Edinburgh.

MILLING CUTTERS

Forged High-Speed. Characteristics of the Forged Milling Cutter, William G. Galkins. Am. Mach., vol. 55, no. 11, Sept. 15, 1921. pp. 424-427, 19 figs. Methods of manufacture. Results of casting and forging high-speed steel. Structure of metal. Comparison of bar stock and forged steel.

Marine. Some Observations on Marine Oil Engines, D. M. Shannon. Mech. Wld., vol. 70, no. 1808, August 26, 1921, pp. 163-164, 3 figs. Discusses systems of oil injection and states that for large marine engines the favorite mechanical injection system consists in having a common pressure main in which oil is kept at 3000 to 4000 lb. and to which all fuel valves are connected (Continued.) Paper read before Inst. Mar. Engrs.

Still. Still Oil Engine for Marine Propulsion. Engineering, vol. 112, no. 2905, Sept. 2, 1921, pp. 344-345, 2 figs. Brief description of engine followed by extracts of report by deputation of French engineers of tests on experimental engine designed and built by Scott's Shipbuilding & Eng. Co., Ltd., Greenock, England.

Vegetable-Oil Fuel. Using Vegetable Oils in Hot-Bulb Engines (Essais sur l'utilisation des huiles végétales dans les moteurs à boule chaude), M. Mathot. Bulletin Technique du Bureau Veritas, vol. 3, no. 7, July 1921, pp. 167-169. Results of tests shows that with palm and cotton oil a H.P. hour requires 265 grains in a 4-stroke-25 hp engine, 320 grams in a 2-stroke-16 hp. engine, 285 grams in a 2-stroke-33 hp. engine, etc. Paper read before the Association pour le perfectionnement du material colonial at Brussels.

OILFUEL

Chemical Research. The Role of the Chemist in Relation to the Future Supply of Liquid Fuel, Harold Hibbert. Jl. Industrial and Eng. Chem., vol. 13, no. 9, Sept. 1921, pp 841-843. Discusses alcohol, saccharifying organisms, and sources other than alcohol. Read before Am. Chem. Soc.

Installations. The Installation of Oil as Fuel, Allen F. Brewer. Power vol. 54, no. 10, Sept. 6, 1921, pp. 361-364, 1 fig. Suggestion for selection of suitable equipment.

MOLYBDENUM STEEL

Constituents. On Constituents Found in Tungsten and Molybdenum Steels, Albert M. Portevin. Iron and Steel Inst. advance proof for meeting Sept. 5-6, 1921, no. 5, 4 pp. 6 figs.; also Engineering, vol. 112, no. 2906, Sept. 9, 1921, pp. 372-373, 6 figs. As results of systematic investigation of special steels author has been able to effect disapperance of obviously hard states (martensitic or austenitic), and to establish fact that certain structures which might have been regarded as being in equilibrium, are superseded by others which represent an even more advanced state of equilibrium.

MOTOR PLOWS

Types. Motor-Driven Ploughs, Dr. Martiny. Eng. Progress, vol. 2, no. 8, August 1921, pp. 169-174, 21 figs. Discusses application of motor-driven plows; describes Stock, Wede, Hansa-Lloyd types.

MOTOR TRUCKS

Advantages. Trucks Pass the Tests of the Times, F. W. Fenn. Power Wagon, no. 202, September 1921, pp. 15-17 and 37. Gives figures showing decrease of horse traffic and increase of motor trucks, and gives examples of advantages of latter.

Dump Bodies. Making Dump Bodies for Motor Trucks. Iron Age, vol. 108, no. 15. Oct. 13, 1921, pp. 937-938, 2 figs. Specialized factory unit of Van Dorn Iron Works Co. arranged for convenience and economy in handling materials. Shipping room is abolished.

N

NICKEL ALLOYS

Nickel-Aluminum-Copper. The Properties of Some Nickel-Aluminum-Copper Alloys, A. A. Read Inst Metals advance paper for meeting Sept. 21-22, 1921, no. 1, 24 pp., 23 figs ; also Engineering, vol. 112, no. 2908, Sept. 23, 1921, pp. 453-456, 22 figs. Continuation of work described in Jl. Inst Metals (vol. 11, no. 1, 1914, p. 169) in course of which a type of alloy was observed which, while extremely soft and ductile on quenching from 900 deg. cent., was considerably hardened by cooling. In present work the properties of alloys of this type are investigated more fully.

O

OIL ENGINES

Injection Type. The Rising Importance of Oil-Injection Type of Internal-Combustion Engine, Charles E. Lucke. Mech. Eng., vol. 43, no. 10, Oct. 1921, pp. 653-658 and 686, 24 figs. Review of development of internal-combustion engine from early gas-burning type to present-day injection engine capable of operating on any form of liquid fuel without explosive shock.

Production and Use. Fuel Oil: Its Production and Use, W. A Whyte Petroleum Times, vol 6, no. 143, July 23, 1921, pp 133-135 Discusses Mexican oils, physical tests, etc (Concluded)

Vegetation. Motor Fuel from Vegetation, T A Boyd Jl Industrial and Eng Chem, vol 13, no 9, Sept 1921, pp 836-841, 6 figs Discusses Shale, benzene, alcohol and cellulose as sources of motor fuel. Read before Am. Chem Soc

OILS

Linseed. A Study on the Oil Bromide Test of Linseed Oil, Thomas A Davidson. Jl. Industrial and Eng. Chem, vol 13, no 9, Sept 1921, pp 801-806. Finds that the centrifuge is most satisfactory for separating oil bromides from reaction mixture, and volatility of either proved no drawback.

Viscosity. Viscosity-Temperature Curves of Fractions of Typical American Crude Oils, E W Dean and F W. Lane. Jl Industrial and Eng Chem, vol 13, no. 9, Sept. 1921, pp 779-786, 7 figs Determines curves for products derived from Pennsylvania, California and Wyoming crude oils

OPEN-HEARTH FURNACES

Design. Open-Hearth Furnace Design, A. D Williams Iron Age, vol. 108, no. 12, Sept 22, 1921, pp 719-721, 6 figs. Reserving valves and their effect on efficiency. Chimney areas and heights.

P

PAINTS

White Lead. Paints, Painting and Painters, With Reference to Technical Problems Public Interests and Health, Henry E Armstrong Jl Roy Soc. Arts, vol. 69, no 3588, August 26, 1921, pp. 655-682 and (discussion) 682-685, 4 figs. Discusses suggested prohibition of white lead; volatilization of lead and turpentine; volatile constituents of paint removers; risks and dangers due to mechanical operation; etc. Is against government interference.

PAVEMENT, BRICK

Types. Features of Brick Pavement Designs for Highways, Jas, C. Travilla. Eng. and Contracting vol 56, no. 10, Sept. 7, 1921, p 238 Deals with monolithic and semi-monolithic types; provisions for temperature stresses; treatment of subgrade soil: etc. (Abstract.) Paper read before Ky. State and County Road Engrs.

PATTERNS

Storage. The Organization of Pattern Stores, H Varley. Eng. and Indus. Management, vol. 6, no. 14, Oct. 6, 1921, pp. 374-376, 3 figs Account of organization of stores shows how economy in time, money and labour may easily be effected by introduction of suitable system.

PISTON RINGS

Design. Important Factors in Piston-Ring Design, H H Platt. Jl. Soc. Automotive Engrs., vol. 9, no. 3. Sept. 1921, pp. 195-197 and (discussion) 197-199, 1 fig. Discusses diagonal and lap joints, design for gas tightness, oil leakage.

POWER GENERATION

Steam, Fuel Economy in. Fuel Economy by the Adoption of Scientific Management in Steam Generation and Utilization, David Brownie. Eng. and Indus. Management, vol. 6, no. 14, Oct. 6, 1921, pp. 393-394 and 396. Discusses cause of losses in steam generation low-temperature carbonization, and flue-gas analysis.

POWER PLANTS

Design. Developments in Power Station Design—VI-XI. Engineer, vol. 132, nos. 3426, 3427, 3428, 3429, 3430, 3431, Aug. 26, Sept. 2, 9, 16, 23 and 30, 1921, pp. 214-216 8 figs., pp. 234-235, 7 figs., pp 258-260, 8 figs., pp 282-284, 9 figs. pp. 324-325, 5 figs and pp 336-338, 6 figs. Aug 26: The Scarab and Badcock oil burners. Sept 2: The Thornycroft oil fuel burners; the White low-pressure system; the Lawton steam jet burner. Sept, 9 The Alldays and Onions, and White oil burners, and the Wilton burner for burning of all classes of liquid fuel. Sept 16: Electrical distance thermometers and CO_2 recorders. Sept. 23: Describes Tozer retort for low-temperature carbonization of bituminous coal Sept. 30: Tozer low-temperature carbonization power plant for South African Carbide & By-Products Co., Natal, with retorts, steam turbine and electric plant.

Economic Operation The Economic Operation of Small Power Plants Malcolm C W Tomlinson Management Eng, vol 1, no 4, Oct 1921 pp 199-204, 4 figs How to reduce wastage of coal, steam, water, electric power, and compressed air.

Evolution. Power-Plant Evolution C F Hirshfeld Mech Eng, vol 43 no 9, Sept 1921, pp 575-578 Discusses decrease brought about in cost of producing electric power and of possibilities of farther increasing plant efficiencies by use of higher steam pressures, air preheating, improved methods of feedwater heating, etc

Ford Plant, River Rouge New Ford Power Plant at River Rouge, Thomas Wilson Power, vol 54, no 9, Sept 6, 1921, pp 348-353, 9 figs Plant featured by large double-ended boilers having 26,470 sq ft of steam-making surface and burning simultaneously blast-furnace gas and powdered coal, complete electrical system and unique substation layout.

PROFIT SHARING

Disadvantages. Thrift Encouragement by Employers—IV, Leonhard Felix Fuld. Indus Management, vol 62, no. 4, Oct 1921, pp 214-215. Writer explains his objections to profit-sharing dividends.

PULVERIZED COAL

Advantages and Disadvantages. Commission on Fuel Utilization (Commission d'Utilisation du Combustible) Revue de L'Industrie Minérale no 15, August 1 1921, pp 511-519 Third Report Minister of Public Works Discusses firing with pulverized coal and summarizes advantages and disadvantages.

Application Application of Pulverized Coal (Renseignements sur l'emploi du charbon pulvérisé), Pierre Appell Chaleur et Industrie, vol. 2, no. 16, August 1921, pp. 510-512. Gives results of tests made in boiler burning 200 kg. per hour.

Boilers. Powdered Coal Under Steam Boilers—III, H. D. Savage. Coal Trade Jl., vol. 52, no. 38, Sept 21 1921, pp. 1049-1050. 1 fig. Survey of results in large industrial plants establishes efficiency of pulverized-fuel combustion.

Colloidal Mixtures. Pulverized Coal and Colloidal Mixtures L. C. Harvey. Eng. and Indus Management, vol. 6, no. 11, Sept. 15, 1921, pp. 310-312. Discusses merits and general features of pulverized coal and its admixture with liquid fuel.

Plant. Development of a Powdered Coal Plant, Charles Longenecker. Blast Furnace and Steel Plant, vol. 9, no. 9, Sept 1921, pp. 567-569. Discusses grade of coal, powdered-coal equipment and furnace changes.

PUMPS

Air-Lift. Experiments on Air Lift Pumping, John S. Owen. Engineering, vol. 112 no. 2908, Sept. 23, 1921,pp. 458-461, 9 figs. Describes experiments made with view to ascertaining most efficient design for air-lift pump, for lifting acid mine liquors in mine in San Domingos, Portugal. Describes installation finally adopted, and gives list of tests showing that it is quite possible to get pump efficiencies with air lifts of between 60 and 70 per cent. Paper read before British Assn.

PUMPS, CENTRIFUGAL

Flood-Proof Pump House Novel Condenser Pump House. Elec. Ry. Jl., vol. 5 no. 11, Sept. 10, 1921, pp. 387-391, 9 figs. American Railways power plant Kenova, W Va., recently enlarged in capacity, now derives circulating wa from new electrically driven centrifugal pumps, housed in a structure which designed to be floodproof.

R

RAILLESS TRACTION

Trolley Buses. Railless Cars at York. Motor Transport, 33, no. 862, Sept. 5'l, pp. 258-259, 2 figs. Description of trackless trolley buses running at 'k, Eng.

RAILWAY CONSTRUCTION

Grading Costs. Expressing Railway Grading Costs by Trend Curves, ıe A. von Rosenberg. Ry Age vol. 71, no 14, Oct 1, 1921, pp. 623-62 figs. Application in Texas of method developed by New England arriers fixing cost of grading when establishing basis for government valuation.

RAILWAY ELECTRIFICATION

France. French Railways Electrification—V and VI. Elec. Ry. and Tramway Jl., vol. 44, nos. 1072 and 1077, April 8 and May 13, 1921, pp. 164-165. April 8: Classification of locomotives according to axle arrangement. May 13: Three-phases system as applied to Simplon line, single-phase system as applied to Swiss Railways, and continuous current at high tension.

Holland. Railways Electrification in Holland. Elec. Ry and Tramway Jl., vol. 45, no. 1095, Sept. 9, 1921, pp. 171-173. Concludes that Electrification must be on the direct-current system and a 1500-volt working tension. Report of special commission.

Italy. Electrification Progress on Italian Railways, Giovanni B. Santi. Ry. Age, vol. 71, no. 10, Sept. 3, 1921, pp. 439-442, 6 figs. A number of hydroelectric plants are under construction, as fuel is expensive and hard to obtain.

Switzerland. The Electrification of the Swiss Federal Railways—I and II. Engineer, vol. 132, nos. 3431 and 3432, Sept. 30 and Oct. 7, 1921, p. 335 and 376-377, 1 fig. Abstract of paper by L. Thorman dealing with technical side of electric traction for main lines in so far as it affects electrification of Swiss Federal Railway. Points out successful use of 15,000-volt single-phase current in Switzerland.

Standards. Standards for Railroad Electrification. Ry. Age., vol. 71, no. 13, Sept. 24, 1921, pp. 583-584. Power should be developed at 25 cycles and use of both alternating and direct current on trolley continued.

RAILWAY MOTOR CARS

Gasoline. The Field for Gasoline Railway Motor Cars, L. C. Josephs, Jr. Ry. Age. vol. 71, no. 14, Oct. 1, 1921, pp. 627-628. Discusses causes of past failures and limitations of successful motor car.

RAILWAY OPERATION

Cost of Stopping Trains. The cost of Stopping a Train, Edwin Winfield. Can. Ry. and Mar. Wld., no. 282, Sept. 1921, pp. 475-476, 1 fig. Discusses train resistance and analyzes cost os stopping.

Freight Traffic, Unit Cost Data for. Unit Cost Data For Freight Traffic. Ry Gaz.,vol.35,no.13,Sept. 23,1921, pp. 458 and 462. Discusses simple method of recording work of freight and mixed trains in order to get ton-mile costs quickly.

Train Control. Train Control Problems Discussed in England. Ry. Signal Engr., vol. 14, no. 9, Sept. 1921, pp. 336-342. Problems of Automatic Train Control by W. J. Thorrowgood; Automatic Train Control by J. Beaumont, Elimination of Frost Trouble by E. W. Kolb; Stop or Proceed vs. Stop and Proceed by A. H. Rudd.

RAILWAY SIGNALING

Electric. Maintenance of A. C. Signal Apparatus, L. F. Viellard. Ry. Signal Engr., vol. 14, no. 9, Sept. 1921, pp. 347-350. Describes experience with a.c. signals and interlockers on Long Island R. R.

Principles of Alternating Current Signaling—VI, J. S. Holliday. Ry. Signal Engr., vol. 14, no. 9, Sept. 1921, pp. 350-352, 2 figs. Vector solutions of correct transformer voltage and distribution of energy between signal motor, slot-coil and lamps.

sition-Light Signal. New Design of Position-Light Signal. Ry. Age. vol. 71, no. 12, Sept. 17, 1921, pp. 538-539, 3 figs. Discusses new Pennsylvania R. R. signaling system worked day and night by uncolored electric lights.

RAILWAY TIES

M ine for Cutting and Boring. Cross-Cutting, Adzing and Boring Machine for Railway Sleepers. Engineer, vol. 132, no. 3431, Sept. 30, 1921, pp. 353-354, 4 figs. partly on p. 348. Built by Indian State Railways by Thos. Robinson & Sons, Ltd., Rochdale.

Pres ving Plants. New Tie Preserving Plant for the Norfolk and Western Ry. ty. Rev., vol. 69, no. 12, Sept. 17, 1921, pp. 353-357, 6 figs. Describes creosot- g plant; facilities for treating 150,000,000 ties annually.

RAILWAY TRACK

Cons tion. On the Question of the Construction of the Road Bed and of the k, E. F. C. Trench. Bul. International Ry. Assn., vol. 3, no. 8, August , pp. 991-1086, 15 figs. Report deals with Great Britain, India, South a, Australia and New Zealand. Gives a large appendix containing an- to question from railways. Concludes that present conditions are sat- ory.

Mainte ce. On the Qustion of the Maintenance and the Supervision of the Track, E Stimson. Bul. International Ry. Assn., vol. 3, no. 8, August 1921, pp. 97 0. Concludes that high costs are due to causes beyond the control of su isory organizations; advises most direct contact between maintenance-of- engineer and division engineer.

RAILWAYS

France. The Great French Railroad Lines in 1920 (Les résultats de l'exploitation des grands réseaux francais de chemins de fer en 1920). Revue Générale des Chemins de Fer, vol. 40, no. 9, Sept. 1921, pp. 141-167. Discusses income and expenditure, rolling stock, traffic, fuel, wages, of the Nord, Est, P.L.M.,P.O., Midi and Etal lines, giving numerous tables.

RECTIFIERS

Mercury. Mercury Rectifiers For Large Capacities, K. Meyer. Eng. Progress, vol. 1, nos. 7-8, July-August 1920. pp. 243-246, 5 figs. Discusses principle and tests with voltages up to 2,000.

REDUCTION GEARS

Machining. Machining Turbine Reduction Gears. Machinery (Lond.), vol. 18, no. 460, July 21, 1921, pp. 481-483, 6 figs. Discusses methods adopted by W. Beardmore & Co. Dalmuir, Scotland.

REFRACTORIES

Physical Characteristics. Physical Characteristics of Specialized Refactories., M. L. Hartmann and W. A. Koehler. Am. Electrochemical Soc., advance paper no. 9, for Meeting, Sept. 29-Oct. 1, 1921, pp. 129-136, 1 fig. Series of tests to determine transverse breaking strength of each of ten refractories, at 20 and 1350 deg. cent. Chrome brick showed most decided drop in modulus of rupture followed in order by bauxite, magnesia, fireclay and silica.

REFRIGERATING PLANTS

Fulton Market, Chicago. Fulton Market Cold Storage Plant, Chicago. Power, vol. 54, no. 13, Sept. 27, 1921, pp. 470-473, 4 figs. Describes economical synchronous-motor-driven refrigerating plant to have eventually 10,500,000 cu. ft. of storage space and 888 tons of refrigerating capacity. Compressors are two-stage machines with injection of liquid between stages and pipe coil in intermediate drum to precool ammonia liquor on its way to brine coolers.

Pipe for. Pipe for Refrigeration Systems. Southern Engr., vol. 36, no. 1, Sept. 1921, pp. 50-54, 8 figs. Discusses dependability bursting pressure, threading principle of pipe, etc.

Reconstruction. Reconstruction of Ice and Cold Storage Plant. Ice and Refrigeration, vol. 61, no. 2, August 1921, pp. 91-93, 7 figs. Sherman Ice Co. Sherman Texas.

REFUSE DISPOSAL

Destructor. Modern Refuse Destructors. Eng. Progress, vol. 1, no. 11, November 1920, pp. 329-330, 6 figs. Equipment, operation, and results of a combined refuse destructor and power station.

ROAD CONSTRUCTION

Refined Tar in. Refined Tar in Road Construction and Maintenance, Philip P. Sharples. Eng. and Contracting, vol. 56, no. 14, Oct. 5, 1921, pp. 343-344. Notes on surface treatment with tar materials applied cold; refined tar in gravel and macadam construction; cold patching method of maintenance. (Abstract.) Paper presented before Can. Assn.

ROADS

Design and Location. Road Design and Location, E. W, James. Can. Engr., vol. 41, no. 14, Oct. 6, 1921, pp. 13, 14 and 15. Fundamental economic considerations ih choosing materials, foundation, etc. Points out that highway of future may have different section every quarter mile.

Sub-Grade Soils. Tests for Sub-Grade Soils, A. T. Goldbeck and F. H. Jackson. Highway Engr. and Contractor, vol. 6, no. 3, Sept. 1921, pp. 35-39, 6 figs. Account of work being done in laboratory of U.S. Bur. of Public Roads.

ROAD, CONCRETE

Construction Methods. Comparison of Three Methods of Concrete Road Construction. Eng. and Contracting, vol. 56, no. 14, Oct, 5, 1921, pp. 334-335, 1 fig. Comparison of wheelbarrow, central-proportioning and central-mixing-plant methods in building 12 mi. of road in Iowa.

ROADS, MACADAM

PENETRATION AND MIXED. Construction of Penetration and Mixed Macadam Roads. L. J. Wulff. Can Engr., vol 41, nos 9 and 10, Sept 1 and 8, 1921 pp 11-12 and 5 and 7. Suggestions for proper construction. Paper presented at conference called by University of Penn.

ROLLING MILLS

MATCHING AND DOUBLING MACHINES. Mechanical Matcher Lowers Cost. Iron Trade Rev., vol 69, no 15, Oct 13, 1921, pp 948-950, 4 figs. Manual work involved in matching and doubling hot rolled sheets is performed by motor-driven machine. Device designed by Lawrence C. Steele, Pittsburgh, [illegible] to offer increased production.

PACK COOLING BED. New Interstate Mill Has Pack Cooling Bed, Gilbert L. Lacher. Iron Age, vol 108, no 14, Oct 6, 1921, pp 857-861, 7 figs. Prominent features of new rolling mill in Chicago is pack cooling bed, said to be first installation of its kind in industry, and hot runout table, all rollers having individual motor drive, those next to bed being of swivelled cone type. See also article on same subject by George H. Manlove in Iron Trade Rev., vol 69, no 14, Oct 6, 1921, pp. 869-873 and 880, 10 figs.

PLATE MILLS. A Plate Mill in Norway With Kramer. Eng Progress, vol. 1, nos. 7-8, July-August 1920, pp 267-270, 2 figs. Describes equipment and working processes of A. S. Norsk Valseverk's installation.

ROLL DESIGN. The Logic of Roll Design—V. W. H. Melaney. Blast Furnace and Steel Plant, vol 9, no. 9, Sept. 1921, pp 513-515, 3 figs. Proportion of wabbler to size of neck for various type mills is considered.

ROTARY PIERCING MACHINES. The Rotary Piercing Machine for Steel and Copper Billets. C. E. Davies. Engineering, vol 112, nos. 2907, 2908, 2910 and 2911, Sept 16, 23, Oct 7 and 14, 1921, pp. 397-399, 429-430, 495-496-527-528, 25 figs. Writer seeks to outline satisfactory theory for rotary piercer. Description and theory is obtained from translation of article published in Stahl u. Eisen (Sept 1919), to which a short summary with remarks on design and use of rotary piercer in England are added. (To be continued.)

SHEET MILLS. The Possibility of Improved Methods of Rolling Sheet Steel, Sumner B. Ely. Mech. Eng., vol. 43, no. 10, Oct. 1921, pp. 670-671. Points out importance of proper heating in sheet-steel rolling and discusses possibility of a continuous sheet mill. Describes a successful Austrian continuous sheet mill.

RUBBER

AGING-TESTS. Ten years' Experience With Aging Tests. William C. Geer. India Rubber Wld., vol. 64, no. 10, Sept. 1, 1921, pp. 887-892, 15 figs. Describes test that can be used for predicting probable effect of natural aging upon vulcanized rubber. Paper read at International Rubber Conference, Lond.

SUBSTITUTES. Rubber Substitutes and the Role they Play in Vulcanization, D. H. Priestly and H. Skellon. Rubber Age, vol. 2, no. 7, Sept. 1921, pp. 351-352. Discusses unsaturated oils and oxydized oils, dark substitutes and white substitutes.

VULCANIZATION. Influence of Certain Organic Accelerators on Vulcanization of Rubber, George Stafford Whitby and Osman James Walker. Jl. Industrial and Eng. Chem., vol. 13, no. 9, Sept. 1921, pp. 816-819, 4 figs. Influence of 1 per cent of (a) piperidine piperidyl-dithiocarbamate (b) hexamethy-lenetetramine, and (c) thiocarbanilide on the rate of vulcanization of a 90:10 rubber-surface mix, etc. Presented before Am. Chem. Soc.

S

SAFETY ENGINEERING

EDUCATION IN. Education in Safety Engineering as Given at the Lynn General Electric Engineering and Apprentice School, N. M. DuChemin. Safety Eng., vol. 42, no. 3, Sept. 1921, pp. 106-112. Outline of lessons presented in ten lectures.

SCIENTIFIC MANAGEMENT

See Industrial Management.

SEWAGE DISPOSAL

ACTIVATED. SLUDGE. Latest Developments in the Activated Sludge Process of Disposal, Harrison P. Eddy. Contract Rec., vol. 35, no. 39, Sept. 28, 1921, pp. 860-864. Deals with most interesting features of process. Paper presented before West. Soc. Engrs.

COLLOIDS AND. Colloids and Sewage Disposal, H. W. M[illegible] and Langdon Pearse. Can Engr., vol 41, no 12, Sept 22, 1921, pp 1[illegible] and 1[illegible]. Relation of colloid chemistry to tank treatment of sewage. Methods of study. Determination of colloids and results of processes for their removal. Paper read before Am. Water Works Assn.

IMHOFF TANKS. Imhoff Tank Experiences in America, Peter Gillespie. Can Engr., vol 41 no 14, Oct 6, 1921 pp 1[illegible] 7 [illegible] 12, 7 figs. [illegible] details of operation, recounts history of [illegible] installations. [illegible] to produce [illegible] quick drying sludge [illegible] principal troubles. [illegible] improved design and more careful operation. [illegible]

MODERN TREATMENT PROCESSES. Treatment of City's Sewage, George A. Johnson. Can Engr., vol 41, no 13, Sept 29, 1921, pp 1[illegible] and 12 and [illegible] 14, Oct 6, 1921 p 11. Activated sludge and direct oxidation processes. Report to City of East Chicago Ind.

SEWERS

INVERTED SIPHONS FOR. Report on Inverted Siphons for Sewers. Jl. Boston Soc. Civ. Engrs., vol 8, no 7, Sept 1921, pp 231-285, 9 figs. Notes on general features, reasons for installing, limiting size, conditions affecting design, desirable and actual velocities, hydraulic principles, methods of computing etc. Includes appendixes giving data relating to inverted siphons in and outside of Massachusetts. Bibliography. Final report of Committee.

SHAPERS

PRODUCTION WORK USE IN. Production Shaping—I. Machy. (N. Y.), vol 28, no 2, Oct 1921, pp 89-93, 5 figs. Use of shapers in production work for planing column and table castings for Avey drilling machine.

SHELL MANUFACTURE

CANADA'. The Manufacture of Shells in Canada During the War, 1914-1918, H. W. B. Swabey and R. Genders. Iron and Steel Inst. advance proof for meeting Sept. 5-6, 1921, no. 10, 17 pp. 13 figs. Notes on method of inspection, heat treatment the Sandberg air treatment and types of defect found in sheell steel. Compilation of statistics. See also Iron and Coal Trades Rev., vol. 103, no. 2793, Sept. 9, 1921, pp. 336-338, 5 figs.

SHIP PROPULSION

GEARING. Gearing For Ship Propulsion. Times Eng. Supp., no. 563, Sept. 1921, p. 252, 6 figs. Discusses single and double reduction, flexible drives, hydraulic transformer.

SPECIFIC HEAT

APPARATUS. New Specific Heat Apparatus Ezer Griffiths. Physical Soc. of Lond. Proc., vol. 33, no. 190, August 15, 1921, pp. 355-361, 3 figs. Describes apparatus for determination of specific heat of cork, charcoal, etc., difficult to deal with by ordinary methods.

LEAD. The Behaviour of Substances Near the Absolute Zero., William R. Fielding. Chemical News, vol. 123, no. 3201, August 19, 1921, pp. 97-99. 1 fig. Discusses specific heats of lead and gives tables for lead, water and copper.

STANDARDIZATION

GERMAN N.D.I. REPORT. Peport of the German Industry Committee on Standards (Mitteilungen des Normenausschusses der Deutschen Industrie). Betrieb, vol. 3, no. 21, July 25, 1921, pp. 319-330, 14 figs. Accepted standards: Blank castel nuts standard screw heads and points. Proposals of Board of Directors for cotter and taper-pin nut locking devices; sizes for technical photographic prints; proposed standards for steel window sash; concrete sewer pipes.

Report of the German Industry Committee on Standards (Mitteilungen des Normenausschusses der Deutschen Industrie). Betrieb vol. 3, no. 22, Aug. 13, 1921, pp. 339-348, 16 figs. Proposals of Board of Directors for relative temperature of measuring tools and workpieces;drive and sunk keys, flat keys, saddle keys,fitted and sliding feather keys, gibhead keys, gibhead flat and saddle keys. Proposed standards for belt-pulley diameters; speeds for transmission-gears; graphic representation by means of curves.

Report of the German Industry Committee on Standards (Mitteilungen des Normenausschusses der Deutschen Industrie). Betrieb, vol. 3, no. 23, Aug. 27, 1921, pp. 355-360, 7 figs. Proposals of Board of Directors for pressure stages for pipe lines; wires and cables for high-voltage overhead lines. Proposed standards for drawings.

STEAM

FLOW MEASUREMENT. Steam Flow Measurements from a Boiler, C. T. Mitchell. Power, vol. 54, no. 9, Aug. 30, 1921, p. 318. Points out importance of constant pressure as regards accuracy of steam-flow records and develops simple formula for calculating amount of steam given off by boiler for given pressure drop, independently of fuel consumption.

HIGH-PRESSURE. High Pressure Steam in Small Power Plants—III, Charles L. Hubbard. Sanitary and Heating Eng., vol. 96, no. 7, Sept. 23, 1921, pp. 199-201, 9 figs. Disclosing functions and principles of steam specialties used in conjunction with power plants, and explaining their mechanical operations (To be continued.)

STEAM ENGINES

Throttle Valves. Throttle Valves for Steam Engines, W. H. Wakeman. Power, vol. 54, no. 10, Sept. 6, 1921, pp. 372-373, 7 figs. Various types.

STEAM GENERATION

Waste-Heat Utilization. Waste Heat Utilization For Steam Generation, G. R. McDermott. Assn. Iron and Steel: Elec Engrs., vol. 3, no. 9, Sept. 1921, pp. 293-319, 7 figs. Gives particulars of tests with waste heat boilers and discusses sources of waste gases, including those from large gas engines.

STEAM GENERATORS

Electric. An Electric Steam-Generator For Low Voltage, F. A. Lidbury and F. A. Stamps. Am. Electrochemical Soc., advance copy, no. 4, pp. 77-86. 2 figs. Describes an inexpensive form of apparatus for the generation of steam by means of alternating current of voltages from 100 to 500. (Abstract.)

STEAM POWER PLANTS

Condensation in Turbine Room. Condensation in Turbine Rooms of Steam Power Stations, L. J. Towne. Stone and Webster Jl., vol. 29, no. 3, Sept. 1921, pp. 119-225. Condensation on walls and ceilings especially inconvenient during winter months. How condensation occurs and fundamental principles which will prevent or minimize this trouble.

Buick Motor Co. The New Buick Plant. Power Plant Eng, vol. 25, no. 17, Sept. 1, 1921, pp. 835-845, 14 figs. Describes coal-handling equipment engine and boiler room, wood-burning equipment and electric equipment of Buick Motor Co., a subsidiaray of General Motors Corp.

Hydraulic-Relay. Requirements in the Design of Steam Power Stations for Hydraulic Relay, E. B. Powell. Mech. Eng., vol. 43, no. 10, Oct. 1921, pp. 650-652 and 674, 6 figs. Flow or head deficiency type of relay; effect of growth of load, seasonal variation of flow and pondage; relay stations for minimum flow development and for higher-load-factor conditions. Emergency reserve type of relay.

Oil-Burning. Efficient Operation of Oil-Burning Steam Plants, C. H. Delany. Mech. Eng., vol. 43, no. 9, Sept. 1921, pp. 602-605, 4 figs. Discussion of plant characteristic diagram with particulars regarding its use in establishment of standard of performance and in increasing plant efficiency.

STEAM TRAPS.

Types. Steam Traps—Types, Principles of Operation, Selection, Installation,Troubles Remedies, L. A. H. Merribew. Power, vol. 54, no. 10, Sept. 6, 1921, pp. 378-381, 4 figs. Savings by proper use of traps; advantage and disadvantages of each type.

STEAM TURBINES

Bleeder. Estimating Steam Consumption of Bleeder Turbines, Joseph Gershberg. Power, vol. 54, no. 15, Oct. 11, 1921, pp. 556-557, 1 fig. Explains convenint method of estimating steam consumption at given load and with given amount of steam being bled.

Curtis Impulse. Efficiency Tests of a 30,000 kw. Turbine, Herbert B. Reynolds. Power House, vol. 14, no. 16, August 20, 1921, pp. 21-25 and 27,8 figs. Turbines are of Curtis impluse type having twenty pressure stages. Gives tables of turbine, condenser and dry-vacuum-pump tests.

Design. Recent developments in Steam Turbine Design, C. J. Everett. Trans. S. African Inst. Elec. Engrs., vol. 12, part 7, July 1921, pp. 131-142, 10 figs. Discusses impluse type; Curtis impulse reaction type; radial-flow type; steam, shaft, and disc packings; blading; etc.

Developments. Some Recent Developments in Large Steam Turbine Practice, K. Baumann. Jl. Instn. Elec. Engrs., vol. 59, no. 302, June 1921, pp. 565-623 and (discussion) 623-663, 49 figs. Part I—Discusses general trend of development, reaction turbines, impulse turbines, turbines for special purposes. Part II—Discusses reliability working conditions, thermodynamic efficiency, overall dimensions, weights and costs in connection with turbine design. Part III—Economic rating of a given turbine frame. Part IV—Maximum output of turbines at a given speed. Part V—Governing of steam turbines. Part VI—Steam consumption guarantees and tests result of large turbines. Part VIII—Operation experience with large turbines.

Efficiency Tests. Efficiency Tests of a 30,000-K.w. Steam Turbine Herbert B. Reynolds. Mech. Eng., vol. 43, no. 7, July 1921, pp. 450-454 and 460, 8 figs. Account and results of tests carried out during 1920 on General Electric turbines at 59th St. power station of Interborough Rapid Transit Co., New York City. These turbines are of straight Curtis impulse type, having 20 pressure stages, each pressure stage consisting of one velocity stage; speed is 1500 r.p.m.

Heat Balance. Heat Balance with House Turbine. Power, vol. 54, no. 10, Sept. 6, 1921, pp. 382-383, 2 figs. Layout of system for obtaining heat balance with house turbine.

High-Capacity. Steam Turbines for Maximum Loads, A. Loachge. Mech. Eng., vol. 43, no. 9, Sept. 1921, pp. 607-608, 2 figs. Discusses magnitudes which determine value of maximum output of turbine technical difficulties which have to be overcome in order to make a high output possible,and ways and means adopted by various concerns to overcome these difficulties. Translated from Zeit. des Vereines deutscher Ingenieure, vol. 65, no. 28, July 9, 1921.

Safe Operation. Safety Precautions in the Operation of Large turbines. Power, vol. 54, no. 10, Sept. 6, 1921, pp. 354-357, 5 figs. Practical pointers on avoiding turbine injury due to spindle deflection blade rub, dummy rub and other causes, together with rules for starting and stopping large turbines.

See also Marine Steam Turbines.

STEEL

Bars, Specification For. British Standard Specification for Steel Bars for the Production of Machined parts. British Eng. Standards Assn., no. 32, May 1921, 13, pp. 4 figs. Specification of bars for production of machined parts suitable for automatic, semi-automatic and turret lathes. Tables of round, square and hexagon bars; Appendix giving forms of British standard tensile test pieces.

Corrosion. Rust Prevention by Slushing Haakon Styri. Am. Electrochemical Soc. advance paper no. 8, for Meeting Sept. 29-Oct 1 1921, pp. 113-128. It is shown that a prerequisite for protection against rust by greases is a thorough cleaning of steel parts by an aqueous solution preferably by oil emulsion which leaves a thin oil film for short time protection.

Elasticity. On the Temperature Coefficient of the Modulus of Longitudinal Elasticity of Steel, H M Dadourian. Lond., Edinburgh, and Dublin. Phil. Mag. and Jl. Sci., vol. 42, no. 249, Sept. 1921, pp. 442-448. Reviews work done on the subject and describes additional experiments.

Fatigue Resistance. Fatigue Resistance of Steel under Repeated Combined Stresses, Akimasa Ono. Jl. Soc. Mech. Engrs. and Soc. Nav. Architects, Sept. 1921. (In Japanese.)

Fracture. Woody Fracture in Steel (Ein Beitrag zur Frage des Holzfaserbruches im Stahl), J. Hanny. Stahl u. Eisen, vol. 41, no. 37, Sept. 15, 1921, pp. 1298-1300. Shows how production of gun steel, it was possible to prevent formation of woody fracture, through measures based on assumption that inclusions of carbon-monoxide bubbles originating in oxides are the causes of such formations.

Mechanical Properties. An Experimental Investigation of the Mechanical Properties of Steels at High Temperatures, E. L. Dupuy. Engineering, vol. 112, nos. 2906 and 2907, Sept. 9 and 16, 1921, pp. 391-394 and 427-428; 33 figs; also Iron and Steel Inst. advance proof, Sept. 1921, no. 2, 22 pp. 33 figs. Determination of mechanical properties of steels in respect of their carbon percentages, at all temperatures between normal and incipient fusion. Experiments were carried out on both cast and rolled material.

Physics in. New Discussion on the Physics of Steel Wm. R. Webster. Blast Furnace and Steel Plant, vol. 9, no. 9, Sept. 1921, pp. 555-563. Application in rolling of effects of carbon, phosphorus and manganese on mechanical properties of steel.

Special. On the Question of Special Steels, M. Sand. Bul. International Ry. Assn., vol. 3, no. 8, August 1921, pp. 1103-1107. Discusses trials with cast manganese steel and Edelstahl cast-steel crossings, also Sandberg processs applied to rails of basic open-hearth high-silicon steel.

Tensile Tests. Elongation and Gauge Length in Tensile Tests, J. H. G. Monypenny. Engineer, vol. 132, no. 3426, Aug. 26, 1921, pp. 220-221, 2 figs. Results of series of comparative tests on a large series of steels to see if it were possible to fix some approximate relationship for commerical use between values obtained on British standard test piece on one hand and French and German types on the other.

Testing. Test for Shock Strength of Hardened Steel, C. E. Margerum. Forging and Heat Treating, vol. 7, no. 9, Sept. 1921, pp. 488-490, 3 figs. Describes apparatus to determine ability to resist impact and gives curves of various impact strength tests. Paper presented before Am. Soc. for Testing Materials.

The Influence of the Width of the Specimen Upon the Results of Tensile Tests of Mild Steel and Rolled Copper, T. Hudson Beare and William Gordon. Engineering, vol. 112, no. 2906, Sept. 9, 1921, pp. 389-391, 6 figs. Results of experiments show that as final thickness is shown to be practically constant for all widths of specimen, decline in percentage of reduction of area is due to gradual diminution in proportional reduction of width. Paper read before British Assn. in Edinburgh.

The Influence of the Width of the Specimen Upon the Results of Tensile Tests of Mild Steel and Rolled Copper, T. Hudson Beare and William Gordon. Metal Industry (Lond.), vol. 19, no. 12, Sept. 16, 1921, pp. 209-212, 6 figs. Details of experiments carried out. Paper read before British Assn.

See also Alloy Steel; Chrome-Nickel Steel; Manganese Steel; Molybdenum Steel; Steel, High-Speed.

STEEL, HEAT TREATMENT OF

Cast Steel. The Thermal Treatment of Cast Steel, Alvin N. Conarroe. Trans. Am. Soc. for Steel, Treating vol. 1, no. 12, Sept. 1921, pp. 746-757, 35 figs. Concludes that steel castings can be refined by heat treatment to possess physical characteristics comparable to forgings: also considers inclusions, segregation, shrinkage, etc.

Characteristic Curves. The "Characteristic Curves" of the Heat Treatment of Steels, Albert M. Portevin and Pierre Chevenard. Iron and Steel Inst., advance proof for meeting Sept. 5-6, 1921, no. 7, 19 pp., 11 figs. So-called characteristic curves combine, within a single diagram, fundamental data of every possible heat treatment and also afford a means of defining accurately the annealed and hardened states of the particular steel.

Drop Forgings. Effect of the Heat Treatment on Steel Castings and Drop Forgings, A. A. Blue. Am. Mach., vol. 55, no. 11, Sept. 15, 1921, pp. 413-418, 26 figs. Results of tests at different stages in heat treatment. Chemical analyses and their results.

Hardened Carbon Steel. Thermal and Physical Changes Accompanying the Heating of Hardened Carbon Steels, Howard Scott and H. Gretchen Movius. Trans. Am. Soc. for Steel Treating, vol. 1, no. 12, Sept. 1921, pp. 758-771, 12 figs. Discusses in detail the transformations in steel below the A1 change.

Overheating, Effect of. Effect of Overheating High Carbon Steel, Lancelot W. Wild. Blast Furnace and Steel Plant, vol. 9, no. 9, Sept. 1921, pp. 541-542. Heating to the Completion of the magnetic change before quenching gives strongest, toughest, best wearing and best cutting steel.

Quenching. Cooling Oil for Quenching Tanks, S. E. Derby. Iron Trade Rev., vol. 69, no. 11, Sept. 15, 1921, pp. 671-676, 5 figs. Proper speed of cooling steel is said to be determining factor in attaining degree of hardness; after determining best temperature of medium it should be maintained by suitable cooling system.

Steel Castings. Heat Treating Improves Castings, Martin M. Rock. Iron Trade Rev., vol. 69, no. 11, Sept. 15, 1921, pp. 677-679. Tensile tests of unannealed, annealed, air cooled and water-quenched steel castings do not disclose marked difference in strength, but impact tests show water-quenched product excels other three.

Tempering. Changes Taking Place in Steels During Tempering (Sur la nature des transformations qui se produisent pendant la trempe des aciers), M. P. Dejean. Revue de Métallurgie, vol. 18, no. 7, July 1921, pp. 419-427, 7 figs. Discusses critical points in cooling of nickel steel, carbon steel, manganese steel, etc.

Volume Changes. Volume Changes in the Heat Treatment of Steel, Leslie Aitchison. Trans. Am. Soc. for Steel Treating, vol. 1, no. 12, Sept. 1921, pp. 734-737, 2 figs. Gives curves showing alterations in volume during heating and cooling.

STEEL, HIGH-SPEED

Heat Treatment. Heat Treatment of High Speed Steel, J. L. Thorne. Trans. Am. Soc. for Steel Treating, vol. 1, no. 12, Sept. 1921, pp. 727-732 and (discussion) 732-733. Discusses composition influence of principal elements, and various stages of heat treating.

Metallurgy. The Metallurgy of High Speed Steel, D. N. Giltinan. Trans. Am. Soc. for Steel Treating, vol. 1, no. 12, Sept. 1921, pp. 716-726, 10 figs. Discusses present requirements of high-speed steels to meet demand for increased production without increased cost; theories of self-hardening.

STEEL WORKS

Anti-Friction Bearings. Anti-Friction Bearings in the Steel Mill, A. M. MacCutcheon. Assn. Iron and Steel Elec. Engrs., vol. 3, no. 9, Sept. 1921, pp. 321-350, 16 figs. Discusses advantages and disadvantages of anti-friction and oil ring type of bearings development of ball and roller bearings, mounting of anti-friction bearings and experiences in various mills.

Fuel Requirements. Fuel requirements of Steel Mills, F. E. Leahy. Ass. Assn. Iron and Steel Elec. Engrs., vol. 3, no. 9, Sept. 1921, pp. 427-435. Discusses application of solid, gaseous and liquid fuels, also pulverized coal.

Railway Electrification. Electrification of the Steel Plant Railroad, R. B. Gerhardt. Assn. Iron and Steel Elec. Engrs., vol. 3, no. 9, Sept. 1921, pp. 277-291. Concludes that electric motor will displace steam engine just as happened in rolling mills.

STOKERS

Capacity and Limitations. Capacity and Efficiency Limitations of Stokers Using Mid-West Coals, John E. Wilson. Mech. Eng., vol. 43, no. 8, Aug. 1921, pp. 536-537 and 561. In case of natural-draft chain-grate stokers, greatest losses are said to be those due to dry chimney gases and carbon in ash. Capacity is governed principally by available draft and ratio of total boiler heating surface to grate area. Notes on use of underfeed and overfeed forced-draft stokers in Mid-West.

Limitations. Limitations of Mechanical stokers Utilizing Mid-West Coals, Edward H. Tenney. Mech. Eng., vol. 43, no. 8, Aug. 1921, pp. 535-536. Points out that Mid-West coals are characterized by higher moisture, volatile and ash contents as compared with Eastern coals. Discusses limitations imposed by air supply and by design of furnace; and effect of these various limitations on stoker operation. (Abstract.)

Low Grade Fuel. Stoking Inferior Fuels, A. Wirth. Eng. Progress, vol. 2, no. 8, August 1921, pp. 185-189, 27 figs. Discusses grates, travelling stokers, removal of slag and ashes.

Travelling Grate Regulators. Speed Regulators for Travelling Grates (Geschwindigkeitsregler für Wanderroste), H. Generich. Zeit. des Vereines deutscher Ingenieure, vol. 65, no. 36, Sept. 3, 1921, pp. 943-944, 5 figs. Describes device for automatic regulation of speed of grate.

STREET RAILWAYS

Cars, Safety. One-Man Safety Cars. Elec. Ry. and Tramway Jl., vol. 44, no. 1077, May 13, 1921, pp. 216-218, 5 figs. Detailed description of Birney one-man safety car.

SUPERHEATED STEAM

Use in Sugar Factories. The Employment of Superheated Steam in Sugar Factories, E. de Bernard. La. Planter and Sugar Mfr., vol. 47, no. 13, Sept. 21, 1921, p. 202, 1 fig. Points out that in order to employ superheated steam, it is necessary to have separate boilers for supplying machine developing motive power and for supplying steam to evaporators, as then different pressures in both cases may be developed.

SUPERHEATERS

Design and Calculation. Steam Superheaters: Their Design, Construction, Application and Use, H. B. Oatley. Mech. Eng., vol. 43, no. 10, Oct. 1921, pp. 663-669, 15 figs. Fundamentals of design and materials used. Characteristics and details of locomotive, marine and stationary superheaters. Operating conditions where reciprocating or rotating prime movers used superheated steam. Results obtained by using superheated steam.

SWITCHBOARDS

Industrial Plants, for. Switchboards for Industrial Plants, Victor H. Todd. Power Plant Eng., vol. 25, no. 18, Sept. 15, 1921, pp. 904-908, 11 figs. Structural features, methods of control, instruments and protective devices.

T

TERMINALS, LOCOMOTIVE

Oklahoma City, M. K. & T. Ry. Oklahoma Engine Terminal and Line Revision; M., K. & T. Ry. Eng. News-Rec., vol. 87, no. 11, Sept. 15, 1921, pp. 440-443, 10 figs. Extensive improvements cover terminal and freight facilities and new entrance to city. Novel turntable. Coal, ash and water-softening plants.

TEXTILE MILLS

Air Conditioning. Air Conditioning in Textile Mill (in Japanese), Masanosuke Yanagimachi. Jl. Soc. Mech. Engrs., Tokyo, Japan, vol. 24, no. 69, June 1921, pp. 11-23, 3 figs.

TIDAL POWER

Utilization. The Utilization of Tidal Power, with Special Reference to the Severn Estuary, F. C. Lea. Engineering, vol. 112, no. 2907, Sept. 16, 1921, pp. 424-426, 8 figs. Writer summarizes preliminary work and investigations necessary before decisions are come to, relative to use of tidal estuaries for power purposes. Paper read before British Assn.

Transmission of Electrical Energy and Tidal Power, T. F. Wall. Engineer, vol. 132, no. 3431, Sept. 30, 1921, p. 345. Brief preliminary outline as system obviating difficulty of varying speeds of turbines, and permitting use of a. c. generators driven directly from turbines. (Abstract.) —Paper presented before British Assn.

TIME STUDY

Foundries. Time Studies in the Foundry, A. G. Peter. Indus. Management, vol. 62, no. 4, Oct. 1921, pp. 244-250, 3 figs. Describes method of graphic analysis of molding work, and its successful operation at Chain Belt Co., Milwaukee, Wis.

Stop-Watches. More Jobs for the Factory Stop-Watch—I. Factory, vol. 27, no. 4, Oct. 1921, pp. 473-475, 1 fig. Describes development of stop-watches and different types which are available for different industrial uses.

TOOL MAKING

Analysis of Production. Analysing Tool Production Problems. Eng. and Indus. Management, vol. 6, no. 14, Oct. 6, 1921, pp. 370-373, 9 figs. Describes methods of analysis and gives results of alternative methods of machining and set-up.

TRACTORS

Cletrac. Smaller Tractor Added to Cleveland Line J. Edward Schipper. Automotive Industries, vol. 45, no. 19, Sept. 8, 1921, pp. 454-457, 6 figs. Describes the "Cletrac" built by Cleveland Tractor Co., weighs 1820 lbs. and can plow 6 to 8 acres a day; can perform other farm tasks.

TRADE UNIONS

Influence on Production. Some Thoughts on Modern Trade Unionism—II, Edward Brown. Eng. and Indus. Management, vol. 6, no. 9, Sept. 1, 1921, pp. 237-239. Its influence on production.

Modern. Some thoughts on Modern Trade Unionism—IV, V and VI, Edward Brown. Eng. and Indus. Management, vol. 6, nos. 11, 12 and 13, Sept. 15, 22 and 29, 1921, pp. 296-298, 320-322 and 356-358. Sept. 15: Discusses share of trades unions in control of industry. Sept. 22: Relation to individual worker. Sept. 29; Is trade unionism the means or the end?

TRANSFORMERS

Connections. A Note on the Interconnected-Star Method of Connecting Three-Phase Transformer Windings, S. Austen Stigant. Elec. Rev. (Lond.), vol. 89, no. 2283, August 26, 1921, pp. 268-269, 3 figs. Compares star-interconnected-star connection with delta-star connection. (To be concluded).

TUBING

Steel. Investigation of the Effect of the Ratio of Diameter to Gage Thickness Upon the Torsional Strength of Steel Tubing. Air Service Information Circular, vol. 3, no. 263, July 20, 1921, 11, pp. 6 figs. Research of investigation showing that modulus of rupture of thin wall steel tubing varies with relation to diam. thickness.

TUNNELS

Lining. Lining the Canadian Pacific's Five-Mile Tunnel. Ry. Age. vol. 71, no. 12, Sept. 17, 1921, pp. 525-527, 4 figs. Describes work in connection with Connaught tunnel and methods and equipment used.

TURBO-GENERATORS

Parallel Operation, Troubles in. Problems in Parallel Operation of Compound Generators, Eustis H. Thompson. Power, vol. 54, no. 12, Sept. 20, 1921, pp. 444-446, 4 figs. Relates series of specific instances of trouble in operation of compound generators in parallel, giving in each case symptoms and causes of trouble, and remedy applied for its correction.

V

VENTILATION

Air Filtration in Buildings. A Study on the Infiltration of Air in Buildings, F. Paul. Jl. Am. Soc. Heating and Ventilating Engrs., vol. 27, no. 6, Sept. 1921, pp. 671-676. 5 figs. Supplementary to report by O. W. Armspach in same journal (Jan.1920), explaning fundamental. principles of experiments being conducted, methods followed etc. Present report contains explanation of several changes and refinements introduced and report of 25 tests conducted in seven different rooms in five different buildings.

W

WAGES

Piecework Payment System. Piecework and Production, H. Varley. Eng. and Indus. Management, vol. 6, no. 11, Sept. 15, 1921, pp. 291-292. Advantages and disadvantages of piecework payment system. Elements of a successful system of payment.

Premium System. The 100 Per Cent Time Premium Plan, L. V. Estes. Management Eng., vol. 1, no. 4, Oct. 1921, pp. 231-234. How it is applied to payment of wages for both individual and gang effort.

System The Wages System and Possible Developments. Eng. and Indus. Management, vol. 6, no. 13, Sept. 29, 1921, pp. 346-349. Abstract of paper entitled Principals of Wages Determination by W. L. Hichens, and one entitled Grading of Labour, by A. W. Kirkaldy, read before British Assn.

WASTE ELIMINATION

Report on Elimination of Waste in Industry Mech. Eng., vol. 43, no. 9, Sept. 1921, pp. 579-583. Committee authorized by Am. Eng. Council and appointed by Herbert Hoover points out wastes and recommends steps for elimination.

WASTE HEAT

Recovery and Application. The Utilization of Exhaust and Intermediate Pressure Steam., H. Dubbel. Eng. Progress, vol. 1, no. 5, May 1920, pp. 173-179, 17 figs. Discusses waste-heat recovery and its various applications.

WATER POWER

Development. Notes on Water-Power Development, A. H. Gibson. Engineering, vol. 112, no. 2907, Sept. 16, 1921, pp. 420-422; also Engineer, vol. 132, nos. 3428 and 3429. Sept. 9 and 16, 1921, pp. 273-274 and 301-302. Notes on world's available water power; power available in Great Britain and British Empire; uses of Hydroelectric energy; conservation; scope for future development and modern tendencies in hydroelectric development. Among questions still requiring investigation are mentioned: turbines, dams, run off, data, tidal power, etc. Papr read before British Assn.

WATER TREATMENT

Chlorination. Problems in the Chlorination of Water—II. Eng. News-Rev., vol. 87, no. 11, Sept. 15, 1921, pp. 444-446. Seventeen water-works operators give experience on effect of temperature on wastes and odors, corrosion of metals and efficiency factors.

Coagulation and Sedimentation. Coagulation, Sedimentation, J. W. Ellms. Can. Engr., vol. 41, no. 12, Sept. 22, 1921, pp. 1, 7 and 8. Application of chemicals and effects produced in treatment of water. New laws are being developed from facts concerning colloidal state of matter. Paper presented before Am. Water Works Assn.

WATERWAYS

Great Lake-Sea. Complete St. Lawrence Project Report, W. A. Bowden and W. P. Wooten. Can. Engr., vol. 41, nos. 11, 12, 13 and 14, Sept. 15, 22, 29 and Oct. 6, 1921, pp. 1, 6 and 7, 1 and 6, 9 and 11 and 8-9, 10 figs. Full text of engineering report on canalization and power development, submitted to Int. Joint Commission.

WELDING

Hammer. Welding; Particularly Hammer Welding. Ernest Edgar Thum. Chem. and Met. Eng., vol. 25, no. 12, Sept. 21. 1921, pp. 553-561, 18 figs. Brief discussion of various modern methods of welding indicating advantages and limitations of each, and field for hammer-welding heavy pressure vessels; operations necessary for hammer-welding steel sheets.

Hyde Process. The Hyde Welding Process. Engineering, vol. 112, no. 2905, Sept. 2, 1921, pp. 338-339, 15 figs. partly on supp. plate Method of uniting iron and steel which partakes of nature of both welding and brazing; consists of uniting surfaces by means of modern copper, the copper impregnating masses of metal to be joined and uniting them in such a way that they cannot again be separated by heat.

Rail Joints. Welding Rail Joints. Welding Engr., vol. 6, no. 8, August 1921, pp. 23-25, 11 figs. Discussion of work done on street railways by Lincoln process.

Thermit and Electric Rail. The Thermit and the Electric Welding Processes with Special Regard to Welding of Rails (Das Thermit-Schweissverfahren und das elektrische Schweissverfahren unter besonderer Berücksichtigung der Schienenschweissung), H. Lange. Elektrotechnische Zeit., vol. 42, no. 27, July 7, 1921, pp. 722-724, 4 figs. Discussion of most important systems.

See also Autogenous Welding, Electric Welding; Electric Welding, Arc.

WINDING ENGINES

Graphical Dynamics. The Graphical Dynamics of a Winding Engine—V and VI, Charles D. Mottram. Colliery Guardian, vol. 122, nos. 3162 and 3163, Aug. 5 and 12, 1921, pp. 378-379, 6 figs. and 448-449, 3 figs. Discusses friction losses in pulley bearings, losses due to drum inertia, drum-shaft friction and inertia or rope on drum. (To be continued.)

WOOD

Microstructure. The Effect of Chemical Reagents on the Microstructure of Wood, Allen Abrams. Jl. Industrial and Eng. Chem., vol. 13, no. 9, Sept. 1921, pp. 786-790, 12 figs. Develops a new method whereby action of reagents may be followed readily by microscope or by photomicrographs.

WOODWORKING PLANTS

Exhauster System. Exhauster Systems in Wood-Working Plants, Sern Madsen. Wood-Worker, vol. 40, no. 7, Sept. 1921, pp. 32-34, 16 figs. Discusses suction required for exhauster systems and gives details of piping for various hood designs.

Globe-Wernicke Co. A Super-Modern Wood Working Plant, Roamer. Wood Worker, vol. 40, no. 7, Sept. 1921, pp. 38-40, 9 figs. Describes plant of Globe-Wernicke Co., Cincinnati, planned on straight-line production through centralized units.

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